NATURE MAGAZINE

rch, 1943 35 Cents Vol. 36, No. 3

Pep Up Your Meetings

Motion pictures of Nature and the Outdoors will take you far and wide in the world of the wild.

Schools; Garden Clubs; Women's Clubs; Nature and Hiking Clubs; Boy and Girl Scout Troops; Church, Civic and Fraternal Organizations; Sportsman and Conservation Groups will be interested in these motion picture films. Thrilling, educational motion pictures help to boost attendance at meetings. They make meetings more interesting and help to promote some educational activities by increasing a knowledge of Nature and the outdoors; developing a consciousness of the need for practical conservation of our national resources and the protection of wildlife.

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11. *Babes in the Woods:* The life of Nature's young in the wild.
12. *Wild Animal Pets:* A naturalist's dog into whose life came many strange animals.
13. *Renting Houses for Songs:* An intimate study of bird life.

GROUP II: A spectacular series of Alaskan reels.

21. *Cruising North:* Murres, sea puffins, bear and other coastal wildlife.
22. *Off to Glacier Bay:* Spectacular pictures of the face of a glacier breaking off and plunging into the bay. Also wildlife scenes.
23. *Wild Animal Outposts:* Hardy Island deer, ptarmigan, bear cubs, blue fox, fur seals of the Pribilofs.
24. *Thar She Blows:* Whales at sea.
25. *Great Bear of Alaska:* Films of the great Kodiak bears of Admiralty Island.

GROUP III: Southwestern series.

31. *Wings to the South:* Bird life of the Texas Gulf coast and the southwest.
32. *Riding the Rimrock:* Searching the rough country of the southwest for its wildlife.
33. *Nature's Side Show:* The struggle for existence in the arid southwest.
34. *Queer Creatures of the Cactus Country:* A study in the adaptation of wildlife to a harsh land.
35. *Getting Personal with Mountain Lions:* A thrilling picture of a pack trip into lion country.

GROUP IV: Photographed along the Continental Divide.

41. *The Big Game Parade:* You meet Antelope, Mountain Sheep, Mule Deer, Elk, Bison, Moose, Brown Bears and Grizzlies.
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Camera Trails

By NORRIS W. HARKNESS

Promise of Spring

MARCH is really the beginning of the year for most Nature photographers. In much of the North, the snow blanket is gone except for patches on north slopes, and the earliest plants are starting to show signs of life. Ponds and swamps are coming to life, too, and the next few weeks are filled with picture opportunities for the photographer willing to go after them.

But most of these early spring pictures need more effort on the cameraman's part than is required for shots later in the summer. The first plant and water life will be found in low, wet places in swamps and near ponds, and the ones that will make the best pictures always seem to be in the toughest spots. Then when you have finally found the place that will make the best composition, you encounter tripod problems. But the pictures you get from the work involved make it well worth while. The frog and toad pictures in this month's rotogravure section are good examples.

March is the perfect time—if one is really better than another—to begin the series of all-year pictures that will show the whole life history of some one or several plants, or even the more ambitious program of the growth history of all of the more outstanding flowers, trees and other plants in your locality.

Recently we saw a series that included many of all three of those classifications, the work of a seventeen-year-old Nature photographer who has now joined the Navy, where he is a cameraman for Uncle Sam. As this is written the large scrap book in which each different plant was illustrated is several thousand miles away and I cannot remember the names of those he had photographed. However, he had a record of the year's life of seven or eight trees, a dozen or more flowers, a number of flowering shrubs, and eight snakes and small water animals.

His method of showing the various series is to divide the book into two main parts, one consisting of separate sections devoted to its own subject, and the other repeating the same pictures but showing them by months and including all his pictures of whatever subject that were made in that month. A few subjects were missing from certain of the calendar pages, but only his donning uniform prevented his completing those few this winter and spring. It is a grand idea and one that leads us to greater interest in all the tremendous number and kinds of Nature pictures that are always around us. Look over the pictures you have already made and see if they will not make a good start toward a scrap book for yourself.

But to get back to the pictures you will make in the next few weeks. Boots are a necessary part of the photographic equipment for the Nature photographer who wants swamp shots. The next requirement is a tripod that is heavy enough to make a firm camera support and flexible enough in its adaptability to be firm when the legs are set at odd angles to take advantage of bits of solid ground near the subject.

Holding the camera in your hands while making such pictures tends to lead to too wide apertures—and consequent small depth of field—in order to get sufficiently high shutter speeds. The light may call for an exposure of $\frac{1}{25}$th second at f/11, yet you need to work at the shortest possible distance and include a considerable depth that will be perfectly sharp in the print. Without a tripod you either open the lens too wide or sacrifice shadow detail by making the exposure too short, but with a good steady one, you can stop the lens down to the limit and give whatever exposure you please. Carrying the tripod is a nuisance between shots, but a great advantage when making the exposures.

The next good help to take along is the foil-covered reflector I have spoken of so often in Camera Trails. Even an eight-by-ten card will throw enough light into deep shadows to keep the contrast of the subject well within the contrast range of the paper on which the print will finally be made.

With the tripod and the reflector, any type of film can be used for any subject that does not move too much, but the making of a good Nature picture needs more than just equipment. It takes thought, time and care to get all the little details just right, but there is no mystery about it. Each adjustment has a definite reason, and its effect on the other connected adjustments, and you have only to set each one after figuring out how it should be done. Then take the picture.

Remember the importance of side-lighting to bring out the maximum depth and roundness in every part of the picture area. For flowers with semi-transparent or translucent petals, working with the light behind the subject may be best, provided the lens is shielded from the direct light and the reflector throws enough light into the shadows.

So watch for your opportunities while all outdoors is feeling the first symptoms of the growing season, and then keep on with that series. It will make a splendid addition to your photographic achievements.

The Question Corner

H. E. J., Montreal, asks: "What shutter speed do I need to stop the movement of a wild duck as it lands on water?"

ANS.—The speed you need for such a subject depends upon three factors, the speed of the duck, its distance from the camera and the direction of its motion. If it is a hundred feet away and flying toward or straight away from the camera, a speed as slow as $\frac{1}{25}$th second might do, but if it is landing five feet away and across the line of sight of the lens, then $\frac{1}{1000}$th second might show slight signs of movement. After his feet have touched the water at the twenty-five feet that is probably the nearest you can get to him, $\frac{1}{100}$th will be all right in most cases, but the wise photographer prefers to err on the safe side and use the fastest shutter speed at his command, which simply means either the highest speed of your shutter, or the fastest the available light will permit. Under all usual conditions $\frac{1}{200}$th will so nearly stop all motion that you need not worry.

F. C., Dover, N. J., asks: "What makes the snow in my winter pictures so muddy? If I expose less in the enlarging there is no detail in the lighter places."

ANS.—Try adding a little potassium bromide to your developer to keep the highlights clean. If that fails, try a softer paper and, with the test strip, get the exposure exactly right. It should add brilliance to the smaller variations and yet hold both shadow and highlight details. Usually muddiness is a sign of too little contrast in the paper, but in a snow scene it

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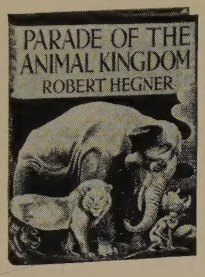

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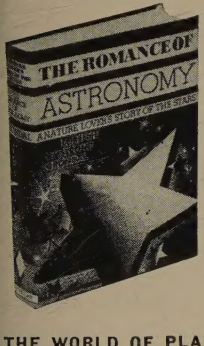

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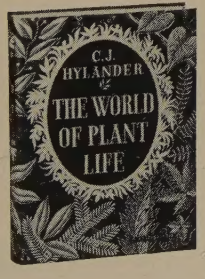

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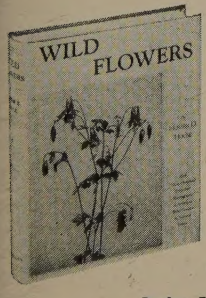

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ANS.—Since you do not mention the brand you prefer, I cannot name its nearest equivalent, but almost any of the popular films in that speed range will work out satisfactorily. For portraiture, you will notice a difference between pan and ortho films in the darker lips given by the ortho, but, except for the darkness of the reds, you will not see any other great difference between them. Filter factors are generally less with the panchromatics. With those variations you will get good results with any well-known make of film. No film can long remain in our highly competitive market if it does not produce results. Take your dealer's advice after talking over your problem with him. He is as interested in your getting good pictures as you.

This and That

From all the indications in Washington, we can expect no immediate changes in the photographic supply setup. All through the latter part of 1942 the industry cringed in anticipation of drastic cuts in the amount of film and paper that the authorities could allow for amateur use, but with the 50 per cent cut established in September and made official by the War Production Board in December, we appear to have reached a level that should continue for some time. It is about the level of the deliveries your dealer has been getting, so there is no reason to fear that amateurs will not have sufficient materials to carry on their regular work with only slight reduction. Care in each step of the entire process from the decision to make the shot straight through the final print will save more material than is represented by the reduction.

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To Stimulate Public Interest in Every Phase of Nature and the Out-Of-Doors, and Devoted to the Practical Conservation of the Great Natural Resources of America

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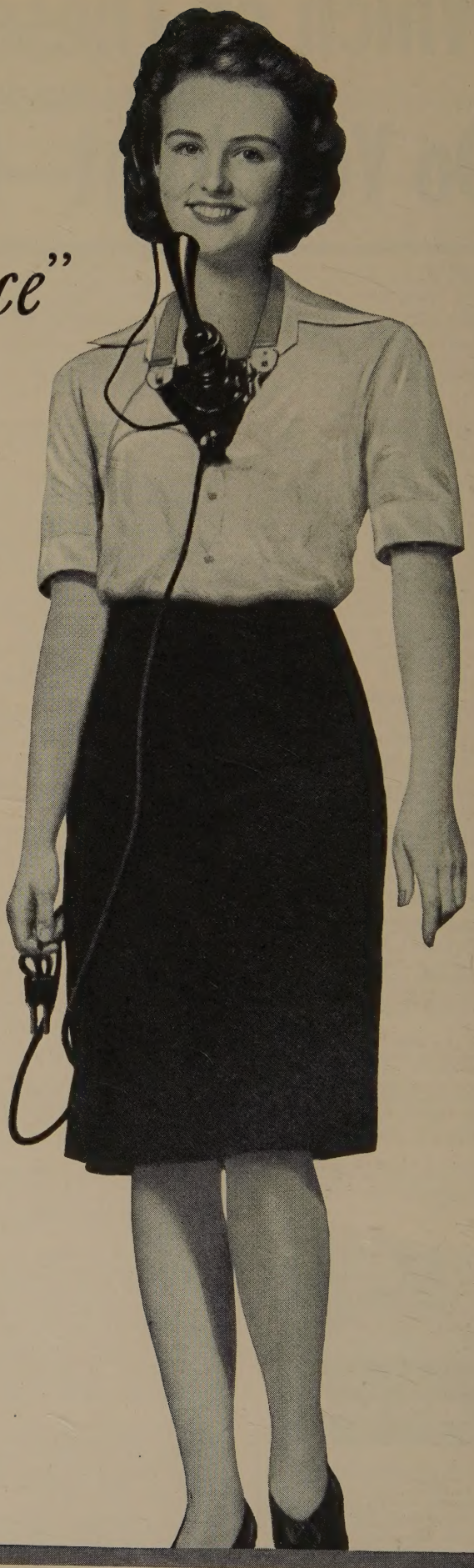

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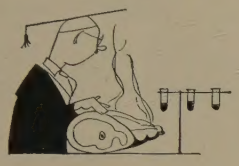
WAR CALLS COME FIRST

BELL TELEPHONE SYSTEM

Contents Noted

Science and chemistry are rapidly taking the romance out of foods and the gusto out of gustatory excursion. Possibly it is all for the best, but we confess to occasional quiet revolt against coldly assaying the vitamin virtues of what is set before us. And now comes smoked ham, which we had always thought of as cured by some sorcery of bucolic occultation handed down from father to son. The chemists advise us that unsmoked meat contains phenols—as though we cared—and that more phenols are imparted by wood smoke. This, it seems, constituted a problem and they had to work out a test to find out how much smoke meat has absorbed. This test is provided by a chemical called 2, 6 dichloroquinone chloroimide, which ruins our taste for smoked ham right away.



From the Maryland-Pennsylvania line to the Nation's Capital, the main highway from Harrisburg and points north and west is lined with hundreds of signs advertising Washington hotels. They seem to vie with each other in attempting to out-billboard the other fellow. Several of them helpfully record the number of miles remaining before you reach their welcoming doorman, although none seem to agree with the distance, or to reveal that you cannot get into them anyway. We *suppose* these myriad eyesores are still there, although our "A" forbids our driving out to look, a trip we could make with a clear conscience, if we had the gasoline, since it certainly is no pleasure to gaze upon these signs. And we cannot help speculating on the grievous waste of roadside beauty and of money these billboards represent—now or in gas-lush days—; money that could far better be spent on some cooperative endeavor, through a clearing house, to make the lot of the enforced visitor to Washington a little easier.

The more we read the writings of the majority of newspaper rod and gun editors—most of whom write under the guise of conservationists—the less hope we have for aid from such a source in solving problems of conservation of wildlife. A recent case in point appears in the *Philadelphia Inquirer*, in which its rod and gun authority consoles the Pennsylvania hunters by pointing out that they need not put their guns away but can sally forth and help farmers by shooting crows. He suggests that hawks and owls be used—presumably tethered—as decoys to attract the crows to the shooter's blind. He also reports that placing a cat in a tree—also presumably tethered—is said to attract more crows than any other decoys. All of which, we suppose, comes under the head of humanity and sportsmanship.

More than a million members of our armed forces were served by our National Parks up to last October, some 890,000 of them entering the parks as visitors, for whom admission charges were waived. The rest have used the parks in connection with one or another type of war activity, such as for training mountain troops and testing winter equipment on Mount Rainier. Fire towers in the parks have been turned over for detection of incendiary sabotage and for air raid warning work. Two coastal National Monuments have been turned over to the services for the duration, and some of the hotels in the parks that will be inaccessible to the public—what with gas, rubber and train travel restricted—will serve as recuperation centers for the boys who have been bearing the burden of action. The National Parks, like the rest of us, must do their part for victory, but their integrity must also be safeguarded because they are a symbol of what we are fighting for.

We never receive a copy of the *Journal of Calendar Reform* that we do not wonder why something is not done about our obsolete Gregorian system. We fail to see any logical objection to the proposed World Calendar with its twelve months and its four quarters of ninety-one days each, plus its one extra "Year-End Day" and its "Leap-Year Day" sandwiched in between June and July every four years. We will confess we never were excited about the thirteen-month calendar idea, but we are unable to see that the "World Calendar" seriously upsets anything. If man can successfully tinker with the time of day, he certainly can equally successfully adopt a sensible and simple re-alignment of the days of the month. Perhaps in the plans for this post-war world the calendar will come in for consideration. In fact it would appear to be a good place to start in achieving that global community that seems to hold the most promise of accomplishing permanent peace.

With many family cars languishing in the garage or able to be taken out for only brief, justified exercise, Dobbin is returning to his own. He has never lost his cherished place in the hearts of many, but today he is beloved again for that part of man's work that he can do. In this equine study, Frank Clodfelter has photographed a pair against the background of the Blue Ridge Mountains of western North Carolina. Both are ready to turn to and do their bit for Victory.

There is cooperation, not conflict, between Nature and the scientist in developing—

The Kingdom of Synthetics

By JAMES K. HUNT

To Nature's three traditional kingdoms—the animal, vegetable, and mineral—chemical research has added a fourth, the kingdom of the synthetic. And products of this new fourth kingdom supplement, rather than displace, materials from Nature's three original realms.

There is no conflict between the natural and the synthetic. In fact, Nature herself is pre-eminent in the field of chemical synthesis. The growth of the giant redwood from a tiny seed; the transformation of mulberry leaves into glistening silk; the formation of sugar and starch from the elements of water, air, and sunshine; even the development of a Nobel prize-winning scientist from a microscopic bit of protoplasm—all are but examples of Nature's marvelous and never-ending synthesis; of her amazing versatility.

In the creation of the new fourth kingdom, man has accordingly only followed Nature's own processes. His synthetic products are neither inferior nor superior—as such—to Nature's products. Indigo derived from coal tar is not different from that taken from the indigo plant, and ascorbic acid made in the laboratory is identical in every respect with the vitamin C from an orange.

But the chemist has done more than duplicate Nature's products. He has created wholly new ones, such as the so-called "synthetic rubbers" so prominent in today's news—which in fact are not synthetic rubber, for the reason that they are chemically different from natural rubber. And in many cases these truly new products are superior to anything found in Nature, for it should be borne in mind that Nature did not have raincoats or automobile tires in mind when she produced the rubber tree, nor a pain-killer when she created the opium poppy. If so, we may assume she would have provided a rubber more resistant to oils, heat and sunlight, and a poppy gum without morphine's pernicious habit-forming characteristics.

To the extent that man has improved upon certain of Nature's products, he has beaten Nature at her own game, but there is still no basic conflict between the scientist and Nature. He makes use of Nature's laws to the fullest extent, relying on the fact that they are as unchangeable as the laws of the Medes and the Persians—in fact, they are immutable, and therefore dependable.

But the scientist does not surrender himself completely to the fundamental laws of Nature. Rather, he tries to find out what natural laws govern the phenomena in which he is interested, so that he may use them, and not violate them, in the pursuit of his objective. But there is no surrender. As recently stated by the eminent research chemist, Dr. Willis R. Whitney, in a letter to the editor of *The Research Viewpoint*: "Surrender seems to call for laying down of arms. But he (the scientist) doesn't 'bat' his wings against bars either. He is a part of Nature and even his nylon is as much natural to him as silkworm extract. In fact, he knows that he can get a more suitable product by being naturally inquisitive, than any bug can incidentally produce as a by-product to his own affairs."

Today on every hand we read or hear about the marvelous new products being made by the chemist and his fellow workers in the fourth kingdom—new textiles, new plastics, new rubber-like materials, new finishes, new industrial chemicals. Scientific advances, we learn, have aided in wiping out ignorance, superstition and disease. Most important of all—in view of the restriction on imports imposed by the war—we are told that products from the fourth kingdom contribute to our independence of foreign sources of supply for materials vital to industry, agriculture and a United Nations victory.

While all of this is true, it is only a part of the truth, and leads those having a normal amount of curiosity to wonder how it all came about. When did man first become dissatisfied with the materials supplied by Nature, and how did he go about shaping them better

Holding degrees in chemical engineering and physical chemistry, conferred by the Alabama Polytechnic Institute and the University of Wisconsin, Dr. Hunt became a research chemist on the staff of E. I. du Pont de Nemours and Company in 1926. At the Du Pont Experimental Station he worked personally on, and later directed research on, a wide variety of products, including paints, varnishes, lacquers, drying oils, asphalts, cellulose derivatives, coated fabrics and textile finishes. For the past six years he has been technical adviser to the public relations department of the Du Pont Company. This article was prepared especially for Nature Magazine by Dr. Hunt.

to suit his needs? How did he learn that coal, petroleum, wood, salt, limestone—even water and air—could be broken down into simpler substances, and how did he learn that these simpler substances might be used to synthesize wholly new products? Was the first such chemical product made by accident or design? Fortunately for those of an inquiring turn of mind, the answers to some of these questions are known.

Nature has been man's only source of materials from the day he started using furs and skins for clothing—at least 50,000 years ago—down to the invention of plastics, "synthetic rubber", and nylon yarn. From man's very advent on earth he has taken Nature's materials and adapted them to his needs as best he knew how. A rudely-woven nest in the tree-tops, or some convenient cave, provided our primitive ancestors with shelter against wind, rain and cold. Wild animals and plants provided food which, until the discovery of fire, was eaten raw. It is easy to picture man's first knowledge of fire, originating, probably, from a tree struck by lightning. Later he learned to use flint and tinder to build his own fire. Perhaps he learned its utility in cooking quite by accident, as in the story told by Charles Lamb in his "Dissertation on Roast Pig". Thus it was that Nature, virtually unaided, provided man's primitive needs for thousands of years.

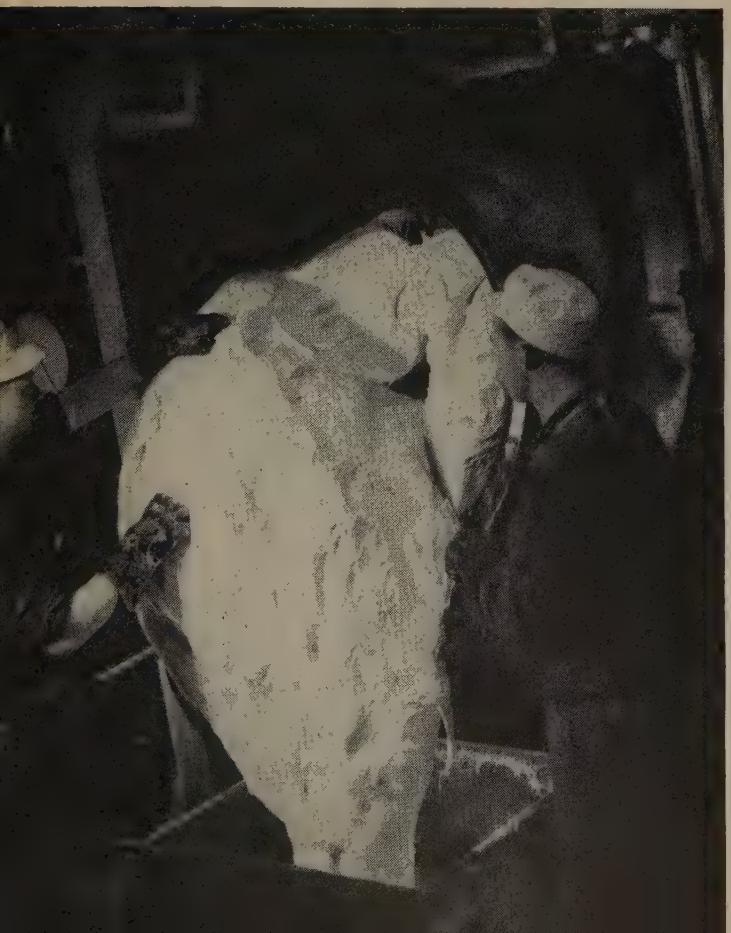
But after struggling along for centuries with materials just as provided by Nature, man learned that they might be modified better to suit his needs. From vegetable fibers he wove rude fabrics, including nets for catching fish. He found that a log hollowed out by fire, and pointed at the ends, could be propelled through the water more easily than a solid log. He learned that sharp and deadly weapons could be chipped from rock. Better still, knives could be fashioned from the copper that was occasionally found in metallic form, and from the iron in "falling stars", which sometimes reached the earth. Many years were to elapse, however, before man should learn the art of smelting metals from their ores. But it should be noted that all these transformations were purely physical. Man was changing only the *form* of the materials supplied by Nature's three kingdoms.

Finally the day dawned—just when, no one knows—when man discovered it was possible to make new things—things wholly different from those found in Nature. Juices from fruits and berries, if kept too long—or, as some might say, long enough—fermented and were transformed into more stimulating beverages. The skins of wild beasts were made soft and flexible by rubbing into them the fat and brains of slain animals. Perhaps chance led to the discovery that extracts of the bark from certain trees transformed skins into tough, durable leather, just as a chance decoction of cinchona bark led to the use of quinine as a cure for malaria.

Tradition says that glass was first made, quite by accident, when a party of Phœnician sailors built a campfire on the sand, in the presence of limestone and natural soda. Perhaps it was likewise by accident that the first man-made metals were produced when a hot fire was built against the wall of some cliff or cave containing the necessary ores. Discoveries of this type, even though wholly accidental, nevertheless marked the dawn of a new day. The chance smelting of copper or tin—relatively simple metallurgical operations—may well have suggested the far more difficult, and scarcely accidental, smelting of iron. A distinct forward step had been taken in man's upward climb. He was no longer wholly dependent on materials just as found in Nature.

As man's knowledge grew and multiplied, his shaping of natural products better to suit his growing needs went on apace. The tin that he had learned to make, mixed with the copper found as such in Nature or smelted from its ores, gave him bronze—harder than either of the parent metals—which for 5000 years has been employed in making a wide variety of implements.

No one knows when the first iron furnace was built, but this versatile metal, although much more difficult to recover from its ores than copper, tin or lead, was



A batch of neoprene synthetic rubber, seen as it comes from the polymerization kettle at a New Jersey Du Pont plant. During recent years thousands of neoprene products have been made—a long list of useful things that have the strength, resilience, abrasion resistance and elasticity of rubber products, besides resisting deterioration from oils, heat, sunlight, chemicals, ozone, and the ravages of age.

nevertheless rather common in the Holy Land more than 3000 years ago, as indicated by its use in making spears, knives, nails, hoes, plows, and even statues. The remains of furnaces and slag piles have been found in northern Palestine dating back to about 1100 B. C.

Man learned to extract dyes from animals, plants and insects. The "Royal Purple" manufactured in the Biblical city of Tyre was made from the precious secretion of *Murex brandaris,* a tiny shellfish found in the waters of the Eastern Mediterranean. Blue for the fabrics in which Egyptian mummies were wrapped more than 5000 years ago was taken from the indigo plant, in the production of which, incidentally, nearly a million acres were in cultivation in India as recently as 1897. Today, thanks to synthetic indigo from coal tar—a research job that extended over a period of fifteen years and cost the Germans $5,000,000—this vast acreage is available for the growth of foodstuffs. A hundred years ago natural indigo cost four dollars a pound. Today, synthetic indigo—much better and more nearly uniform in quality—costs less than twenty cents a pound.

Although these early chemical adaptations of Nature's products marked the beginning of a new era, it should be emphasized that the chemical products used by our early ancestors were, for the most part, relatively easy to make. No complex synthesis was involved. It took many centuries for man to learn how to take apart the materials supplied by Nature—the air and the sea, rocks and minerals, plants and animals—and to use the resulting "building blocks" in the erection of new structures—structures which in many cases are more useful and beautiful than any of Nature's own materials.

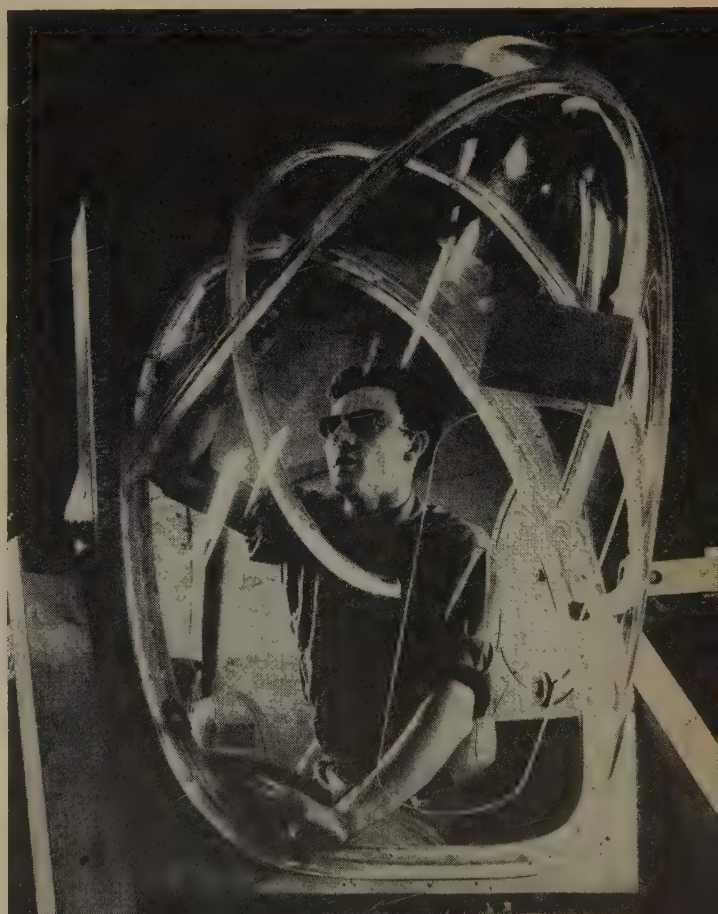
It is not possible to say just when the conquest of the new chemical kingdom was started, and "started" is the right word because even today the conquest is by no means complete. Nor can we point with certainty to any one particular event as marking the beginning of this conquest. But some of the more significant developments are well known to the student of historical chemistry.

The ancients made practical application of many principles of chemistry, but it is doubtful if they recognized any fundamental relationship among the various chemical operations that they carried out—wine making, the smelting of metals, glassworking, and dyeing. For the most part these operations were carried out with the same naive simplicity as that exhibited by a modern child with an electrical toy. Without any knowledge of Faraday's principle of electromagnetic induction, he closes the switch and watches his electric train go round and round its track. Each chemical operation practiced by the ancients was a separate and distinct craft, handed down through the years from father to son, or gained by long apprenticeship to some acknowledged master. There was, however, no unified body of facts that might be called "chemistry".

Furthermore, scientific progress among the ancients was painfully slow. For one thing, experimentation was beneath the dignity of philosophers, while those who worked with their hands were, for the most part, too ignorant for any constructive thinking. Progress was retarded also by tradition—by the dictum *ipse dixit* (he himself has said it), and the authority of bygone teachers was not to be questioned.

While the old Greek scholars made numerous worthwhile contributions to mathematics, they had no direct, first-hand knowledge of chemical changes, and their social position forbade contact with those who could have given them practical information. Leave manual labor and experiment to slaves—pure thought alone was worthy of the philosopher.

Thus it was that the ancient scholars made no worthwhile contributions to what we know today as chemistry. The "glory that was Greece" gave us the immortal sculpture of Phidias, the classic poetry of Sophocles, and the drama of Aristophanes, but no new textile fiber, plastic, or synthetic chemical for the prevention or cure of disease; not even a worth-while chemical theory in those days of philosophical glory.



This crystal-clear nose of "Lucite" methyl methacrylate plastic, for a Martin bomber, is one of the largest plastic pieces ever manufactured on a mass production basis. Measuring about 4000 square inches in surface area, and weighing more than forty-five pounds, this three-dimensional nose even has ribs of "Lucite". This was made by the Du Pont plastics department.

Thales, the first of the Greek philosophers of whom we have any record, who is believed to have lived about 600 B. C., is known to chemists for his brilliant pronouncement that water is the origin of all things. About a hundred years later, Anaximenes contended that air is the fundamental substance. Heraclitus (536-470 B. C.) taught that all matter had its origin in fire. Empedocles (490-430 B. C.) regarded earth, air, fire and water as the four "elements" from which all materials are made. This theory was expanded by Aristotle (384-322 B. C.) to include a ghostly fifth element which he called the "essence" of matter,—hence the term *quintessence.* Democritus (470-360 B. C.) taught that all matter was made up of small, incompressible, indivisible particles, which he called atoms. He went so far as to teach that knowledge was to be gained through experiment, but there is no evidence that he ever practiced the experimental method.

Thus scientific knowledge stood at the end of the period of classical civilization, some 300 years before Christ, and thus it remained throughout the Dark Ages. But in the Middle Ages science began to make real, albeit slow, progress. Whereas theory and practice were completely divorced among the ancients, in the Middle Ages the experimental method began to be employed by the theorist—a time-tested device for keeping at least one foot on solid earth. From the chemist's point of view, the most significant intellectual phenomenon of this period was the rise and spread of alchemy—mystical mixture of true science, blind superstition and rank fraud—from which comes the word "chemistry".

When and where this forerunner of chemistry had its origin are not known, but early alchemical literature contains references to the ancient Greek philosophers, Egyptian gods, Sarah, wife of Abraham, and even Adam. The first authentic alchemical literature, which was voluminous if not always trustworthy, belongs to the fourth century A. D., and is associated with the Egyptian city of Alexandria.

While the early alchemists spent most of their time in a vain search for the elixir of life—to drink which would confer immortality—and for the philosopher's stone, which, once it were found, would heal all diseases and change base metals into gold, they nevertheless made a very real contribution to science. To their everlasting credit, they *experimented.* In their efforts to obtain the philosopher's stone, they heated, distilled and combined everything they could lay their hands on, and in this way many important chemical reactions were carried out and many new compounds prepared.

The Renaissance—revival or rebirth of learning—which began in the 14th century, saw a revolt against the dogmatic religious authority, which had hindered the progress of science, and this revolt gave impetus to the general intellectual awakening. The invention of printing around 1440 meant a wider diffusion of books, and of learning. This was also the era of great discoveries and discoverers—Columbus, Vasco da Gama, Cortez, Pizarro and Magellan. A newly-aroused interest in Nature stimulated men like Leonardo da Vinci—possibly the greatest genius of all time—to make experiments designed to throw light on the workings of Nature's laws. Leonardo even studied aviation, and the airplane he designed might well have flown if a suitable engine had been available. Copernicus, a Polish astronomer of the 16th century, developed the theory that the earth rotates about the sun, and that the latter, rather than the former, is the center of our solar system. Observations with the telescope,

A reflux unit used by Du Pont chemists to test resistance of a brown dye to various metals. Each flask contains a piece of metal and a prescribed quantity of dye in solution. After the solutions are boiled for 24 hours, comparative tests are made of the effect of the metal on the shade, strength, and other properties of the dye.

evised a century later by Galileo, an Italian physicist, pheld the Copernican theory. At about the same ime, the Swiss alchemist and physician, Paracelsus, ed his fellow alchemists to leave off their search for old and devote their time to the preparation of medi-ines.

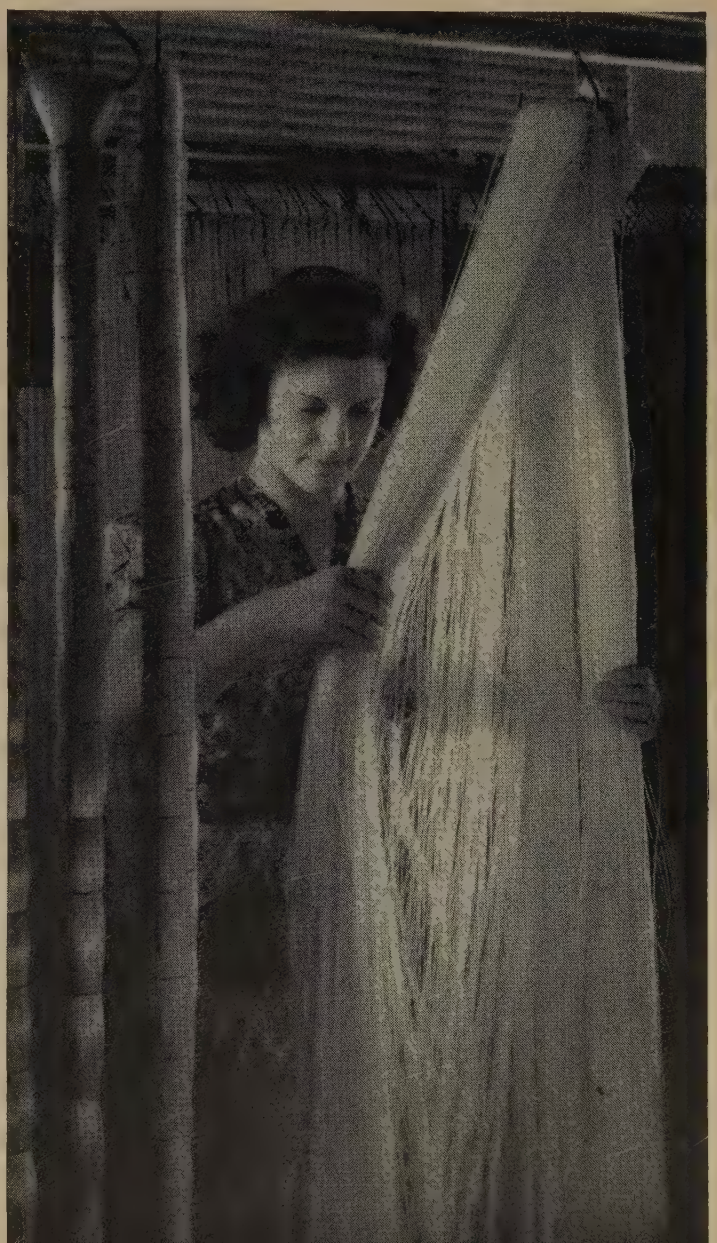
During the 15th and 16th centuries increased at-ention was given to investigating the properties of ubstances, and chemistry gained by the fact that it egan to be studied by physicians and others who ossessed the highest scientific culture of the time. But transmutation was still uppermost in many minds. Perhaps the last investigator of an early day who laimed to have changed mercury into gold was the Belgian chemist and physiologist, Jan Baptista van Helmont, who died in 1644. But then, van Helmont aught that mice could be produced by mixing meal with dirty rags!

Perhaps it should here be emphasized that there was nothing inherently absurd in the efforts of the alchemists to change lead and other base metals into gold. They had observed that the very essence of chem-cal change is for a material with certain properties o disappear while another, with wholly different properties, takes its place. Was not silvery, fluid mercury obtained from red, crystalline cinnabar? Then why might not lead be transformed into gold? As a matter of fact, the modern chemist has carried out a number of transmutations. He has trans-ormed the metal lithium into gaseous helium, odium into magnesium, and—what has probably aused many an alchemist to turn in his grave—mercury has even been changed to gold. But it should be made clear that these transformations wrought by the modern scientist are made possible through the use of tools—such as the cyclotron—of which the ancient alchemist never even dreamed.

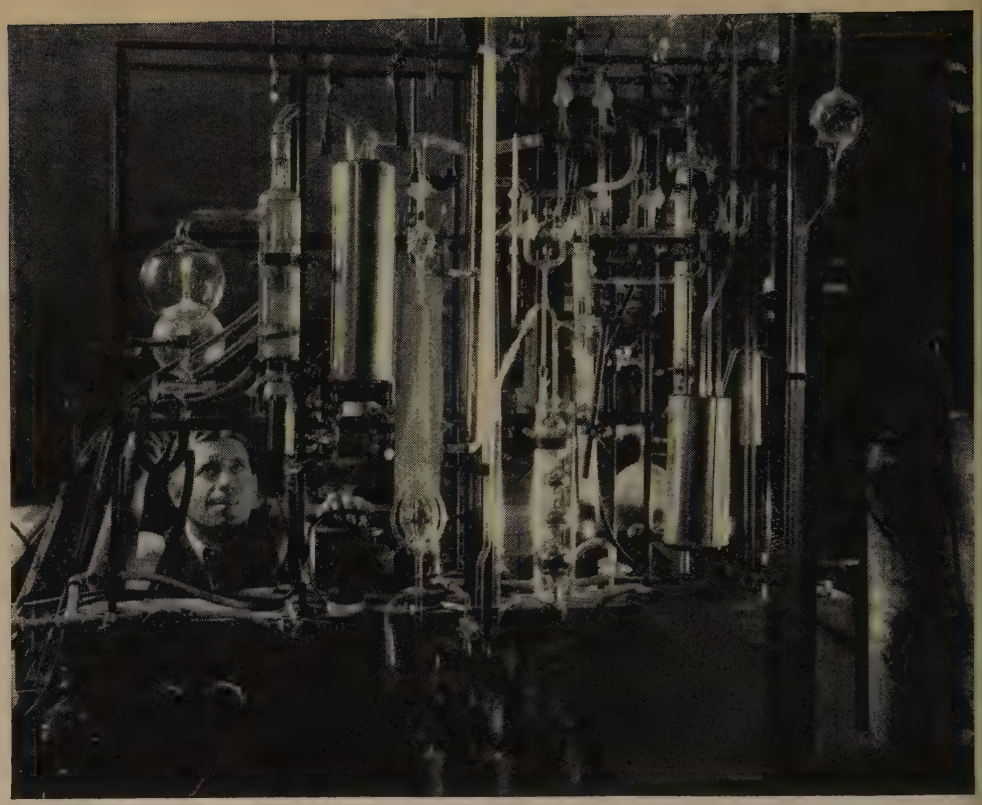
While chemistry made but slow progress even in the 17th century, from then on progress was more rapid. Space permits mention of only a few of the highlights of the period leading up to the era of modern chemistry. Andreas Sigismund Marggraf, the German scientist, made the significant obser-vation that phosphorus gains weight when burn-ed. Previously it had been held that combustion involved loss in weight. Karl Wilhelm Scheele, the Swedish apothecary, in spite of an endless strug-gle with ill health and poverty, was a tireless re-searcher, demonstrating, among other things, that the atmosphere is made up of two gases—"fire-air" and "spoiled-air"—thereby paving the way for a true explanation of burning. The English clergyman, Joseph Priestley, contemporary of George Washing-ton, discovered oxygen, and was forced for politi-cal reasons to flee his native land, taking up residence in Pennsylvania. Finally, there was Antoine Laurent Lavoisier, the Father of Modern Chemistry.

Whereas the chemistry of metals and minerals—so-called inorganic chemistry—was advanced by the early alchemists in their quest for gold, the chemistry of plant and animal substances—organic chemistry—received no such impetus from alchemy. Until the time of Lavoisier, developments in the field of or-ganic chemistry were limited chiefly to practical im-provements in dyeing and medicine. But Lavoisier aroused new interest in the nature of organic matter and devised methods for its analysis.

It should be remarked that Lavoisier's analysis of organic matter paved the way for subsequent chemical synthesis, for without knowledge of the composition of a material, it obviously would be impossible to build it up from its elements. In fact, Lavoisier carried



Inspecting a hank of finished nylon, which is ready for use in tooth, hair and industrial brushes as bristles. The tied-up hanks have been bound preparatory to cutting up the nylon into bristle lengths. The picture was taken in a New Jersey plant of the Du Pont plastics department, where work with nylon is carried on.



This picture would suggest that a disciple of Rube Goldberg had been turned loose in a laboratory. However, this is a complicated high-vacuum apparatus in the Du Pont chemical department. It is used for measuring the surface area of fine powders, such as pigments. In the case of certain very fine powders, the total surface area of the particles in one teaspoonful may total 1000 square feet.

out what is probably the first deliberate chemical synthesis. After showing that water is made up of hydrogen and oxygen, he reversed the process by burning hydrogen in an atmosphere of oxygen to form water.

Lavoisier did something that none of his predecessors had done. With laboratory scales he studied the *quantities* of materials involved in various chemical reactions. By burning weighed quantities of materials and carefully weighing the products formed, he was the first to arrive at the true nature of combustion, a phenomenon that had puzzled man since fire was first known. The numerous researches of this eminent French scientist gave impetus to the Chemical Revolution.

In 1793 Lavoisier, who had served his country tirelessly in connection with matters pertaining to taxation, coinage, banking, public charity and scientific agriculture—as well as chemistry—was so unfortunate as to give personal offense to the bloodthirsty Marat, one of the leaders of the French Revolution. It seems that Lavoisier had pointed out some glaring errors in a book that Marat had written about fire, and then, as now, some authors were extremely sensitive to criticism. Tried before the Revolutionary Tribunal on various trumped-up charges, Lavoisier was sentenced to death by the guillotine, the judge remarking: "*La Republique n'a pas besoin de savants*"—the Republic has no need for learned men! The Father of Modern Chemistry went to his death calmly and with dignity, as befits one who in life strove to do his full duty, and feared only that which was false.

From here on the pace quickens. In 1828 the German chemist, Friedrich Wöhler, synthesized for the first time one of Nature's own organic products. The product was urea, a substance formed by the life processes of certain plants and animals. Until that time it was thought impossible to synthesize in the laboratory materials produced by animals or vegetables. The smashing of this theory by Wöhler was accordingly an important advance in man's conquest of the new kingdom of synthetics. Nature's monopoly was broken.

About 30 years later, the youthful British chemist, William Perkin, undertook to synthesize quinine. As frequently happens in the laboratory, Perkin did not get what he was looking for. Instead, this 18-year-old boy got something vastly more important. He synthesized the first coal-tar dye—the delicate purple mauve—and thereby paved the way for the synthetic dyestuff industry. Another outpost in the conquest of the chemical kingdom had been won.

Thus through centuries of research it became apparent that materials from Nature's vast storehouse could be broken down into their elements, or into simpler compounds, and that these simpler substances could be employed in making countless useful synthetic products—products that Nature either forgot to make, or failed to provide in quantities sufficient for man's needs. Until World War I, much of this work was done in Europe. In fact, Germany had a virtual monopoly on dyestuffs, drugs, and other synthetic chemicals derived from coal tar. But during the past quarter century, the United States has established her chemical independence no less surely than her political independence was established more than 150 years ago. Today America's (Continued on page 158)

Working rapidly at the water's edge, with the tide out, the harvesters strip the Burgundy-colored dulse from the rocks and gather it into baskets; later it is transferred to sacks and carried to the drying ground.

Prepare for a race against the tide
and some back-straining work when you go—

Dulsing at Dark Harbour

By ETHEL WILSON

Food, these days, is a major topic of conversation. The vitamin and mineral contents of our diet are carefully considered, and items hitherto ignored take on importance because of their particular qualities. One such is dulse, which is the name applied to several species of coarse seaweeds found on northern seashores. The species most commonly known as dulse is *Rhodymenia palmata,* long a common food in the British Isles and Iceland, but elsewhere expensive and a luxury.

Dark purplish-red in color, this dulse grows on rocks and algae in tidal sea water. Rising from a disk, the frond consists of a short, cylindrical stem that spreads out into a thin, broad, fan-shaped membrane, six to twelve inches long and four to eight inches wide. This is deeply and irregularly cleft into many wedge-shaped segments. It contains iodine and is rich in mineral salts, which gives dulse a medicinal value as well as contributing to what the dietitians tell us is a balanced diet. Iodine is a preventive of goiter.

One of the few places where dulse is found in quantity on the shores of the western Atlantic is in the Bay of Fundy. Near Dark Harbour, on the north side of the Island of Grand Manan, it flourishes in quantity. The harvest season lasts from the middle of May to mid-October, and the seaweed soon returns to the rocks from which it has been stripped.

A dulsing expedition in this region, whence for more than a half century dulse has been shipped away, is a rare and exhilarating experience. Tides must first be reckoned with, for the sea leaves the dulse uncovered for a bare two hours. So the dulser must be on time and ready to gather rapidly.

Equipped with high rubber boots, laden with strong Indian baskets of ash, and supplied with dozens of sacks, we set out at five in the morning. As we came down to the northern shore, gray rocks of countless sizes and shapes clattered beneath our feet, and we sounded like a troupe of Dutch children treading the cobbles in their wooden shoes. Across the area of barnacles and rockweed we trudged and slipped, until we came to the strip of shoreline where the Burgundy-colored sprays of dulse clung to the rocks. Each sea-smoothed boulder seemed like a hat, from the crown of which was draped a splashy satin bow. Wedging our toes in spaces between the rocks, we lifted the dulse into the baskets, working fast against the return of the tide. Filled baskets were emptied into sacks, and we

Spread out on the smooth, white stones on a specially-prepared drying strip, the dulse dries in about six hours and then can be rolled up like a rug and stored.

raced along trying to learn the trick of keeping our footing as we worked.

When the tide served notice that it was returning to reclaim our rocky garden, the filled sacks were carried to the drying ground. This was a strip about one hundred and seventy-five yards by eight that had been laboriously levelled by removing the larger rocks and leaving the small, flat, immaculate ones. Dulse must be sun-cured, and the wind helps, too. We had both that day. Because the uncured seaweed is perishable, it must be cured the day it is picked, and the process takes about six hours. When fog suddenly sweeps in there is likely to be much loss, so the dulse expert tries to harvest on a day in which he has confidence.

When first cured the dulse turns black, but proper conditions restore it almost to the red it had when growing. From the hopper at the edge of the drying ground, the expert lets the leaves of seaweed fly lightly from his hand in a rotary motion. They land to stand like shavings, with most of their surfaces exposed to sun and air. There is certainly an art in drying dulse.

Returning to the drying ground after six hours, we found that the seaweed had shrunk to one-fifth its original bulk. It was then in such a state that it could be rolled up like a rug and stored.

Culinary advice about dulse varies. Some suggest that it should be put in a pan and fried as soon as picked. Others put it on the stove and let it frizzle up, finding it then ready to chew. One old lady said, "Dip it in vinegar and then eat it." Another recommendation was that it should be eaten along with a piece of molasses candy. Children start to chew it at about four years, and seem to love its fishy, salty flavor.

Twenty years ago dulse was shipped by the carload to the Pacific Coast. Pioneers from "down East" took its taste with them when they went West, for it carried the tang of the ocean. The demand still obtains and it is shipped in quantity to Vancouver. Dulse has even adopted the modern dress of cellophane packaging, and thus travels afar in style and in small quantities.

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Miniature

By BERNICE BROTHERSTON

I found the nest
Of a humming bird
In a sumac tree;

A little
Lichen thimbleful
Of family.

The Life and Loves of Ivan the Terrible

By LESLIE T. WHITE

Ivan and the author, who points out that Ivan is the smaller mammal shown here. At the left, the little white cottage in which Ivan had his romance. He peers from the door.

IT WAS on a jungle trail near Bahia, Brazil, that I first met Ivan. He was in an argument with a native, and his temper fascinated me. Swelled up in barrel-chested majesty, his tiny yellow eyes ablaze with fury, he was fulminating at the top of his lungs. But the odds were against him, for Ivan weighed only *three ounces.* I interceded and, upon the transfer of fifty cents, became the custodian of Ivan the Terrible. He was not grateful; he acted as if I had cheated him of a victim, and proceeded to give me a piece of his mind. Then his temper subsided and he went to sleep in my pocket. I sawed a coconut shell in half to make a house for him and took him back to the ship on which I was to return to this country. Awakening sweet dispositioned and affectionate, he immediately became the darling of the ship.

Ivan was a *saguim de noite,* a night monkey. On his forehead is a luminous white fur that glows in the darkness and lures moths and bugs, which he captures with bewildering rapidity. He was three and one-half inches tall; he had a tiny human face and hands, a brown and yellow squirrel-like body, and a long, furry tail. His temperament was warm and sentimental when he had his way, but when crossed he would fly into a temper—which, however, quickly burned itself out. He is, I learned, a species of pygmy marmoset.

The ship's officers warned that he could not live

away from his jungle habitat, but I determined to bring him home alive. Since I had no precedent to go by, raising him was a matter of trial and error. At the first port I purchased a doll's milk bottle with a rubber nipple; Ivan handled it like a veteran tippler. One of the women on board knitted him a tiny turtle-neck sweater that made him look like a midget prize-fighter. I put him on a leash when I took him for periodical promenades on deck; he caught the idea at once and was unbelievably clean.

Although I have experimented with various kinds of animals from African lions to Scottish terriers, Ivan's intelligence amazed me. Once I left him in his cage in too-strong sunlight; upon returning I found that he had rigged a shade in his cage with his blanket. When I removed the shade and sat down to watch, Ivan

Ivan clings to one of the athletic bars in his cage, which housed him in comfort and made it possible safely to carry him about. He is not an easy camera subject, rarely being still enough.

promptly replaced the blanket just where he wanted it.

When we reached California I built him an ornate little red and yellow cage fashioned like an old-time circus wagon, about three feet long, two feet high and a foot deep. The ends were glassed, the back was hinged as a door and the front was covered with wire mesh. His bedroom was a small cigar box, over which I installed a bedlamp whose 25-watt bulb supplied just enough heat to maintain the cage at an even temperature. His coconut shell was suspended from the ceiling, and there were swings, dangling bells, and a trapeze for exercise.

Ivan has scant sympathy for those people who insist that it is cruel to cage a wild thing, for he loves civilization. One of his major thrills is—or was!—travelling by automobile. We hang his coconut shell from the mirror by the windshield and from this vantage point he surveys the countryside. He chatters excitedly, much like a small boy, when something unusual catches his attention. Instead of desiring freedom, he fears it. Once we set his cage out in our patio so he could bask in the sunshine. He did not like it, so he reached his hand out, unlatched the door of his cage, and scampered back to the house. Apparently his worst enemy in the jungles was the vulture, for he flattens in terror whenever a bird passes overhead.

He came to adore the American breakfast. He demands his orange juice immediately on rising, and if my wife serves me ahead of him he has a temper. We give him a few drops of viosterol in his juice, a little calcium mixed in his vegetables or fruit, and his *pièce de résistance* consists of three mealy worms. He gained weight and now weighs more than five ounces. Because small monkeys are extremely susceptible to pneumonia we cannot bathe him, but we found that an imported dry-shampoo, which we rub into his fur and then brush out with a toothbrush, is an excellent substitute.

He is the most fastidious animal I have ever seen. He will take a whole grape in his little mouth, then tilt his head back and squeeze all the juice out of it, rather than get his hands sticky and soiled.

Ivan decided he liked his new life, and opened his heart to all and sundry. However, his friendliness was not reciprocated by Sandy, my dour old Scotch terrier.

Ivan is an incurable tease, and one day he dived on Sandy's back and rode him around the room. My heart stopped, for in a dog fight Sandy is a killer. But the old Scot, a thorough gentleman, simply came over to me to have the nuisance removed. Now, after two years, Sandy has developed a dignified tolerance, if not affection, for the little imp. Shortly after this incident, Ivan created a working partnership with Sandy that always provided amusement for my wife and me. The front door of our home, which is panelled with glass, afforded Sandy a view of the street, and it was his custom to watch for passing dogs and—much to Ivan's delight—set up a terrific clamor whenever he spotted one. That summer, I erected in front of our property a tall, solid fence that blocked Sandy's vision, and for a few weeks he had no guard duty to perform.

From his cage in a window Ivan has perfect visibility up and down the street, so he began to tip Sandy off every time anything passed the house. He never learned that Sandy's venom is directed only at other dogs, so, at his warning signal, old Sandy rushes through the house and hurls himself viciously at the front door—without having the remotest idea at what he is barking. How the two reached this tacit understanding, or how Sandy recognizes Ivan's signal from the rest of the monkey's inane chatter, is beyond me.

We thought that Ivan was destined to go through life a bachelor, but fate interceded. A friend of mine in Rio, learning of my success with Ivan, gave me a tiny female *saguim*, and romance entered the life of Ivan the Terrible.

Tonita, an incredibly tiny little hoyden, was only about half the size of Ivan. We gave her viosterol and liquid vitamins and exercised her by forcing her to

climb a walking stick. I did not think it wise to put her in with Ivan until she was a little older and larger, but one day I held her up to the glassed end of his cage so that he might see her. At first he turned away, thinking that it was just another mirror trick, but when she spoke, he nearly fell off his trapeze in amazement. When he realized that she was a young lady, he completely lost his head. His obvious excitement made me fear for her safety, so we postponed the "wedding" for a while. Eventually we built her weight up to three ounces.

Meanwhile, Ivan was consumed with curiosity. He would pace his cage, swelling his chest like a miniature gorilla and showing off. Tonita thought him magnificent, and was most anxious to visit him. Whenever we turned her loose she headed for his cage. But Ivan knew his stuff, for whenever he found her looking at him, he would turn his head away just to impress her with the fact that he did not care a hang. Yet when she was not watching, he would follow her every movement with his little yellow eyes.

Finally we set the date for the marriage. I built them a tiny ivory cottage, trimmed with blue, to go in the cage. Over the door was a plaque reading "Mr. and Mrs.", and beside the window a tiny sign which said "Do Not Disturb." My wife presented a pair of small pink blankets as a wedding gift.

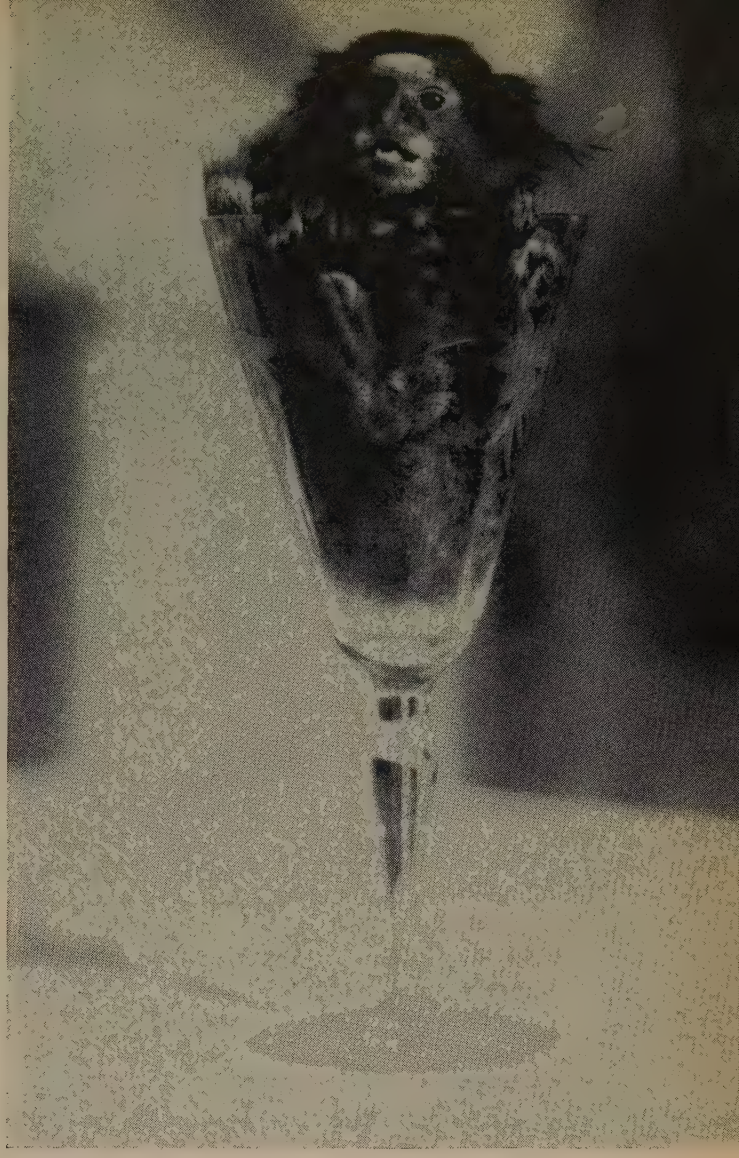
Knowing Ivan's volatile nature, his jealousy and his temper, I was apprehensive for Tonita, and when I steered her into his lair I wore heavy leather gloves so that I might rescue her if Ivan lost his head. Ivan's teeth are something to reckon with.

Ivan, the little dope, took one look at the lady, then his courage evaporated; before I could close the door of the cage he dove outside and ran all over the house, while Tonita, the little bride-to-be, looked hurt and bewildered.

When we corralled Ivan and put him back in his cage he was completely embarrassed and walked around in a daze. Tonita, evidently a female of experience, took the initiative. Boldly cornering Ivan, she grabbed him securely by his ears and kissed him hard.

Ivan was stunned. Tonita stroked him and tried her best to be affectionate, but the reluctant bridegroom shied away, climbed to a corner of his screen and stared indifferently into space. Poor little Tonita, puzzled and frustrated, turned her attention to the cage itself. Dazzled by the luxury of her new surroundings, she tested his trapeze and the other equipment, then reclined in his coconut shell. Further than this their romance did not go all day.

That evening I put their bright new cottage into the cage. Tonita was bewitched by the splendor, and promptly climbed inside. After a brief examination she stuck her head out the door and called to Ivan, but the little ninny was afraid to go in with her. When he finally peeked inside, Tonita grabbed him and kissed him. He nearly swooned and raced to a corner.



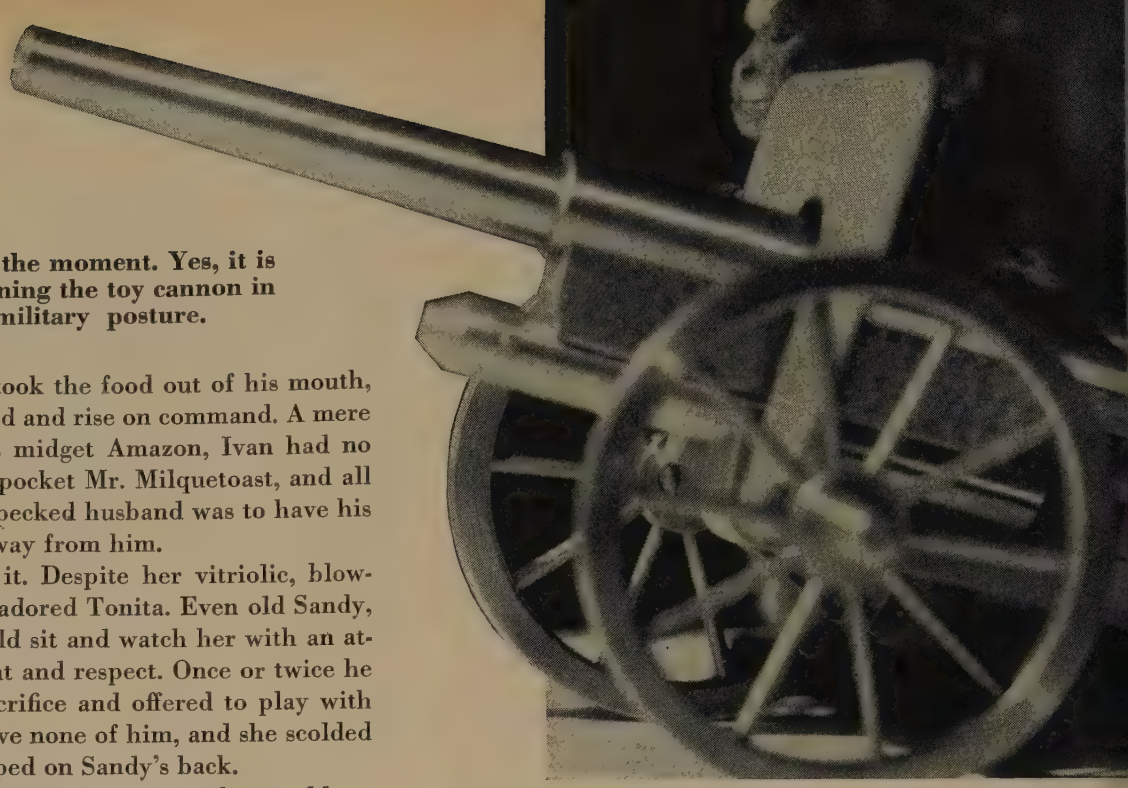
A glassful of Tonita, Ivan's little bride, who tipped the scales at three ounces. At first most unromantic, Ivan was won over by his little mate and was desolate when fate took her from him.

She remained in the cottage cooing at him and acting coy.

Disgusted with Ivan, my wife and I went to a movie. When we came home I raised the removable top of their cottage and peered in. They were cuddled up together and snuggled down for the night. Ivan acted guilty, as if caught doing something he should not do, but on Tonita's ugly little face was an expression of smug content.

Now that marriage was an established fact, Tonita dropped her shy pose and set out to show Ivan and the rest of us who was boss. It became impossible to regard her as a monkey; she was much too human. If you took a great vat and filled it with women—clubwomen, fishwives, rich wives, poor wives—and boiled away all the fat, the wind and the water, you would have Tonita. She was the dehydrated essence of the female.

We could no longer talk to Ivan without her crowding him aside and giving us an argument. She never



Ivan in the mood of the moment. Yes, it is Ivan, not a Jap, manning the toy cannon in a thoroughly military posture.

stopped talking. She took the food out of his mouth, she made him go to bed and rise on command. A mere male, caged with this midget Amazon, Ivan had no chance. He became a pocket Mr. Milquetoast, and all he lacked to be a henpecked husband was to have his pay envelope taken away from him.

Yet he thrived on it. Despite her vitriolic, blow-torch personality, we adored Tonita. Even old Sandy, arch cynic of all, would sit and watch her with an attitude of bewilderment and respect. Once or twice he made the supreme sacrifice and offered to play with her, but she would have none of him, and she scolded Ivan whenever he leaped on Sandy's back.

Promptly after dinner each evening she would retire alone into their cottage and pull the blankets over the door. For an hour she would remain in privacy. What she did in there we shall never know, but it reminded me of a woman retiring to remove her make-up. Eventually, she would brush aside the blanket and summon Ivan. He would bound inside and the blanket would cover the door for the night.

Thinking to aid Ivan to his old independence I would take him out of the cage alone, leaving Tonita penned up, but he acted like a bridegroom on his first night out with the boys. He kept glancing nervously towards his cage, as if wondering if he was going to get into trouble when he got home. No longer would he rough-house with me as of yore, or tease Sandy, and at the first opportunity, he would head back to his wife.

The difference in their personalities was amusing. Tonita was cheeky, cute, quick-tempered and stolid. She would screw her face up into the funniest little scowl, and then chatter noisily when we laughed. Ivan was nervous, restless, playful and a tease. Sometimes he would pretend to fight with me, biting gently and wrestling. He loved to grasp my wife's long hair and slide down her tresses, or hide behind a chair and make comical grimaces. At first he teased Tonita, pulling her tail while she chattered and scolded. But she adored it, for if he stopped she would heckle him for more.

I have been long interested in the fact that few animals can grasp a two-dimensional object; dogs, for instance, never seem conscious of a motion picture. Myself, I have not made any tests at the theater, but the several operators with whom I have discussed the subject all agree that a dog cannot, or does not, see the screen images.

With this in mind, I marched Ivan to the show one afternoon. Now Ivan prefers blondes—definitely. Not because he is a gentleman, but merely that he apparently associates brunettes with the natives of his jungle home. Brunettes to Ivan are natural enemies, with rare exceptions. Now it happened that Madeleine Carroll was playing to Ivan's first show, and her blond beauty intrigued him immensely. He showed great interest in Madeleine and grew quite excited over the close-ups of the love scenes.

So when the *Jungle Book* in technicolor came to town, we took Ivan and Tonita in their little traveling cage to see the picture. Through the courtesy of the manager, we had a very soft light turned on the little monks so we could watch their reactions. If you saw the picture, you remember that it had lots of tigers and other wild animals, including apes and monkeys.

Ivan and Tonita were bug-eyed with excitement. Little Tonita nearly swooned over the melodramatic scene in the cave when the cobra fanned his hood to attack the heroine. She made nervous little chattering sounds and cuddled up close to Ivan, for all the world like a small girl. Ivan grunted reassuringly, but his own tiny body was quivering. They ducked when they saw the tigers, and gave every evidence that they recognized the types of animals, especially when they saw the monkeys. After the show, they appeared to be having considerable discussion about it. Of course any interpretation of their actions is purely guesswork; only the actions themselves can be claimed authentic.

Finally my wife's romantic hopes were realized—Tonita was going to become a mother! Ivan knew it too, for he began to worry if she was out of his sight for a moment. He offered to fight with me when I picked her up for her brushing. No husband could have exhibited more com- (Continued on page 162)

The world in which "Crooked-Neck" was fated to live was, indeed, a topsy-turvy one. How he came to be that way is shrouded in mystery. There seemed to be no dislocation of the owl's vertebrae, which seemed to indicate that the deformity had not come from a fall. The bird was nearly mature, as indicated by his flight feathers, and one wonders how he was fed if this wry neck was something with which he emerged from the egg.

The Case of "Crooked-Neck"

By GUY VAN DUYN

PERHAPS it was by way of getting a clearer picture of the topsy-turvy world into which he had been hatched that "Crooked-Neck" viewed his surroundings in vertical reverse. On the other hand it seemed incredible that such a grotesque congenital deformity would have permitted him to consume parental offerings of mice, rats, and rabbits with sufficient ease and regularity to attain the nearly mature owl-hood that his all but full-length flight feathers evidenced. Then, too, he had apparently fallen from the nest, and even grown showed an impaired sense of equilibrium—which was scarcely surprising.

I had been enjoying a morning of eagle banding with the indefatigable dean of that strenuous pursuit, Charles L. Broley. For two years this "good neighbor" from Delta, Ontario, had included our Myakka River State Park in the itinerary of his Florida banding tour of habitats of the bald eagle. In the few short years since he took up this valuable work as an intriguing hobby, Mr. Broley, working single-handed and without other compensation than the personal satisfaction derived, has already banded many more of these magnificent birds than had previously been tagged by the combined efforts of all other banders. Needless to say, his work has contributed much to our knowledge of the home life and wanderings of our great National Bird, so long ignorantly persecuted as a predator.

We had already investigated two nest trees during the morning. The first, a sturdy, green pine, had presented no problem for Mr. Broley's highly-developed climbing technique. The nest held a lone eaglet, perhaps five weeks old—satisfactory for banding purposes. The second nest proved to be deserted, perhaps because of the precarious condition of the old dead pine, for this tree fell not long after our visit.

As we approached the third nest tree, a rather squat, spreading slash pine, we did not know that a pair of great horned owls had "muscled in" until Mr. Broley discovered the owl fledgling huddled at its base. According to him, such invasions are not unusual; the eagle, apparently no match for the smaller but far more ferocious nocturnal predator, simply evacuates and seeks residence elsewhere. Indications are that infant mortality among eagles from this source may prove to be considerable.

In evidence of the aggressiveness of the great horned owl, *Bubo virginianus,* my friend cited the fact that among the several hundred eagles' nests visited he has yet to be attacked by either parent. He discreetly avoids any nests known to be usurped by these owls, however, following a terrifying and painful experience in the case of the last one visited. Now, eagles' nests are sturdy structures composed of stout dead branches running up to wrist-size diameter, and it was with

A brief instance of almost normal posture of "Crooked-Neck's" head. Now and then he would get in such posture, then quickly revert to the upside-down aspect, twisting his head always in a clockwise direction.

such a stick, hastily snatched from the nest, that he tried to defend himself against the irate returning owl parents. He met one oncoming bird squarely with a blow of this weapon, yet it nearly knocked him out of the nest. Moreover, its talons went home in his scalp and face, one missing an eye so narrowly that the blinding flow of blood momentarily prompted fears of a lost eye. How he managed to withdraw from combat without further disaster is still not quite clear to him.

It was obvious now, too, that he had not forgotten that lesson, for, as I bent to photograph the ludicrous nestling, Mr. Broley wasted no time in securing an effective-looking war club and kept a wary eye cocked for trouble. Nor were the old birds slow to appear. But they swooped on silent wings to vantage points in the nest tree, whence they glared balefully, confining themselves to occasional vocal protests. Perhaps they sensed the decided advantage man held when on his own terra firma.

With a view to attempting to solve the mystery of the youngster's cervical peculiarity, I took it along to camp. Several questions needed answering: Had it injured its neck in falling from the nest, or had it fallen out as a result of the infirmity? If the latter, what was the cause of the affliction, and was it congenital or of recent origin? If recent, was the bird able to feed, and would it survive?

Palpation disclosed that there was no dislocation of vertebrae, at least, and continued observation revealed occasional brief instances of practically normal head posture. But the head quickly reverted to the completely up-side-down aspect; at times, indeed, it was twisted even slightly past 180 degrees—always in clockwise direction.

But my questions were destined to remain unanswered, for an unscheduled week-end absence became necessary. "Crooked-Neck" had not yet attempted to feed, and, rather than entrust to others less interested the proffering of victuals I returned the bird to the site of its capture, after an overnight absence. And a visit two days later unfortunately revealed no trace of its whereabouts or fate.

It would be interesting to learn whether any readers have observed instances of similar affliction among our wild birds. I have a vague recollection of hearing of something called "wry-neck" among domestic poultry, but know nothing of its symptoms, cause, or prognosis. And so, I must leave to another the solving of the mysterious case of friend "Crooked-Neck".

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Without Sight Or Sound

By HARRY ELMORE HURD

One might expect the spring to come
With audible rhythm like a drum
Beating on a distant hill,
And yet it comes as strangely still
As coursing blood within the veins.
We feel the pulse of throbbing rains:
We suddenly become aware
Of something surging in the air
That is not winter. No one sees
Beauty bursting from the trees:
No dial moves across the face
Of time to indicate the place
Where winter ends. The silent year
Dissolves to spring: we feel it near
But when it came, or where, eludes
Perception. Silvery etudes
Of song and symphonies of green
Reveal the glory linked between
Two mysteries—as old as earth
And as miraculous as birth.

as been going on for years. The situation has improved, but not enough. Today we are faced with a reat urgency. Every American must be made to realize that if he is responsible for a fire that destroys any part of a forest area he is just as much a saboteur as the enemy agent who plots against a war industry.

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Thoughts on Conservation Education

The January, 1943, issue of *The American Biology Teacher*, the official publication of the National Association of Biology Teachers, is devoted almost in its entirety to conservation education. Every issue of the publication is provocative, practical and useful. But, having struggled for nearly twenty years with this question of conservation education—where it should start; where it belongs in the school curriculum; how it can be accomplished in point of approach—we are naturally particularly interested in this discussion from the biology teacher's viewpoint. Quotation of some of the thoughts expressed may be helpful.

"No other course in the high school curriculum offers so great an opportunity to teach conservation of our renewable resources as does the course in biology," says Ellsworth Lumley, Seattle high school teacher. He asserts that "it is a gross mistake to teach the identification of living things, their relationship to each other and their manner of life, while at the same time witnessing and ignoring the useless and wicked destruction of these same living creatures." He points out that there is no sense in telling students about old problems that were faced and settled by their parents. Instead, the students must be apprised of problems they themselves must face. How they cope with these will "depend not only upon the scientific information they have acquired in their biology classes but also upon the way they have been taught to think and draw conclusions. Here the biology teacher has an excellent opportunity to teach the difference between facts and propaganda."

Mr. Lumley is convinced that, "given the facts, the average high school student can find the correct solution to conservation problems more readily than the average adult." This is because the student is not impeded by preconceived notions, prejudices and selfish desires. Mr. Lumley recommends the consideration of controversial problems, for it is these that are most misunderstood and mismanaged, and "which need to be covered so that our future citizens will not bungle the problems as other generations have done."

"Conservation may not be easy to teach," says Mr. Lumley, but a real teacher finds his reward in seeing his students do straight thinking and then practicing in their daily lives the lessons they have learned. They become ardent defenders of the living resources of America."

Stanley Sprecher, Mitchell, Oregon, high school teacher, agrees with his colleague, saying that "for an understanding of the basic principles behind the conservation of our natural resources (soil and water, forest wealth, wildlife and the mineral resources) biology classes are being recognized as the logical place in the high school to teach conservation." He asserts that conservation instruction provides "an excellent means by which high school biology can be made into a living practical course. . . . School is intended to serve as preparation for the future; the development of an intelligent attitude toward resource use is therefore of value to both the individual citizen and to the nation in which he is to take an active part as voter, and as resource-user."

B. L. Eyestone, Keokuk, Iowa, high school teacher, says that it is to be assumed "that the advisability of including conservation of natural resources instruction in the curriculum needs no defense." He then gives a practical program of pupil activity in carrying this assumption into effect. He starts with a seasonal order and with soil conservation as a basis, enlisting cooperation of nearby progressive farmers in providing a laboratory where soil erosion may be studied and controlled. The by-products of this activity come in logical order and lead to the restoration of the soil value and the wildlife habitat that is provided by such regeneration.

Others who contribute valuable suggestions to this useful issue of *The American Biology Teacher* include A. J. Ludden of McCook, Nebraska; E. Laurence Palmer of Cornell University; Arthur H. Bryan of Baltimore City College; and Elmo Stevenson of Oregon State College. It is most encouraging to find the biology teachers getting behind conservation education. It augurs well for the future.

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Wartime conditions and manpower problems that confront our printer make it impossible to adhere to a fixed schedule for the delivery date of Nature Magazine. We ask the indulgence of our readers and members, for our printer and ourselves, in overlooking and understanding delays.

As We See It

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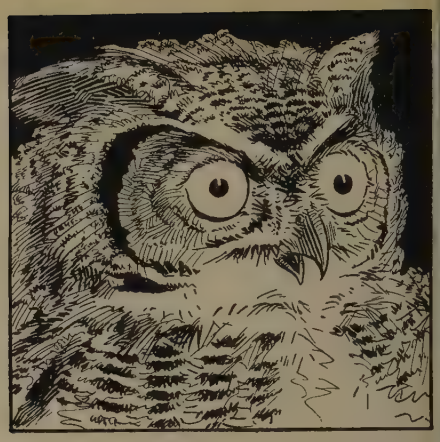


Forest Fires Aid the Enemy

An Editorial

"Careless Matches Aid the Axis" was the slogan last year; "Our Carelessness Their Secret Weapon" is the warning for 1943. Whatever the catch line may be, and whether it be emphasized by a picture of a grimacing Jap—as last year—or by a toothy Hirohito and a bug-eyed Hitler—as this year—the forest fire is the problem these publicity devices seek to bring home to the American people. As Secretary of Agriculture Wickard puts it: "Until we smash the Axis every man-made forest fire is an enemy fire."

Why the wanton waste of fire must be checked should be obvious to everyone. Wood is a critical war material; just as critical as steel, aluminum and many other vital resources. In his annual report the Chief of the United States Forest Service points out:

"The nation's forests are being called upon for a tremendous output of materials essential to the war effort. Billions of feet of lumber are needed to house the expanding American armed forces and the growing army of workers in war industries. Wood and wood derivatives are needed for ships, wharves, airplanes, gunstocks, explosives, and a host of other war materials and facilities."

During 1942 some eight billion board feet of lumber are estimated to have been required solely for boxing and crating war materials, and for agricultural products and essential civilian goods. The need for 1943 certainly will not be less. For Army beds alone more than thirty million feet of hardwoods will be needed this year. A million feet a day will be required for the bodies of Army trucks.

"It is imperative," says the Forest Service Chief, "that the number and size of forest fires be held to a minimum during wartime to avoid disorganization of transportation and communication, to prevent diversion of industrial labor or military forces to the unproductive task of fire fighting, and to avert direct damage to forest resources and industries and facilities located in forest areas.... With the menace of sabotage and of possible incendiary bombing by the enemy added to normal hazards, the Nation faces greater danger from forest fire than ever before."

The needs of the armed forces and the demands of war industries have depleted the regular ranks of the Forest Service and State forest-protection agencies. The Civilian Conservation Corps is no more. Normal civilian reserves for fire-fighting work have been cut down because of the wartime diversion of man-power.

To meet this situation the fire-spotting organization has been intensified. The Office of Civilian Defense has cooperated in establishing a service of fire-fighters. The Civilian Air Patrol is on the watch for fires. Emergency appropriations have been made by Congress to throw greater protection around critical areas. Science has been enlisted to provide meteorological means for measuring fire danger and interpreting fire behavior, thus aiding planning for fire control.

The cold—or, perhaps, we should say hot—facts are that an average of some two hundred thousand forest fires annually burn over an acreage almost as large as the State of New York. Ninety percent of these fires are man-made. Thirty percent of them are started by careless smokers and campers. Forty percent are intentionally set to clear plow land, or to burn off logging slash and other brush and debris. Thus the war effort is sabotaged by slowing down production, diverting men from essential labor and creating smoke conditions that seriously interfere with training airplane pilots, as well as providing a cover that hides enemy submarines from our air patrol. Such a condition might well provide protection to the Japs in the invasion attempt that they seem to cherish as a possibility.

Thus all mechanical resources, and those of available man-power, are being mobilized to meet the menace of forest fires. But that is not enough. There must be *fewer* fires. That means that those who carelessly toss aside a cigaret in forested areas; those who carelessly leave a fire in the woods; those who carelessly start a fire to burn off acreage and let it get out of hand, must realize that in so doing they are playing ball with the Axis.

The education of the public to the forest fire menace

A portrait of a handsome male evening grosbeak, one of eighty that spent the winter of 1941-1942 as guests of the Treadway feeding station at Williamstown, Massachusetts.

"Henry" braved all kinds of wintry weather on a hotel roof in Williamstown, holding out a standing invitation to all birds to "Come and get it" when food was hard to find.

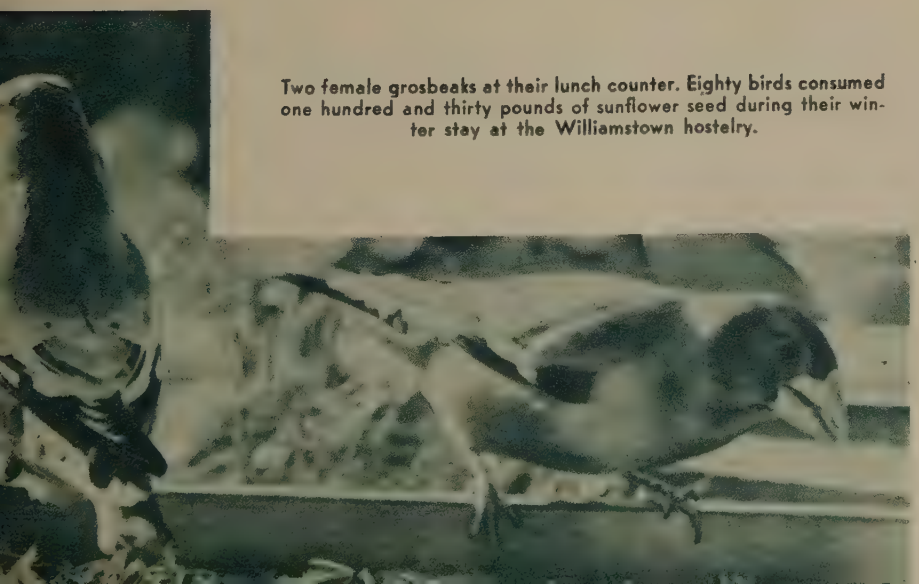
A Gathering of Grosbeaks

By MAURICE BROUN

Photographs by the Author

It all began a number of years ago, when a bird-loving schoolboy, John F. Treadway, planted a young box-elder in his garden in Williamstown, Massachusetts.

A few years rolled by, and then one winter's day a host of evening grosbeaks, resplendently clothed in gold uniforms with black and white trimmings, flashed down from the skies and took over that box-elder, with its generous stock of seeds and buds. Sunflower seeds, also a favorite food of the grosbeaks, supplemented the maple fruit. The boy, grown to young manhood, was richly rewarded. In late years he has had the good fortune to entertain these wanderers from the Northwest about three winters out of every five. And many of the townspeople have been gladdened by the bright wings and cheery personalities of these striking birds.



Two female grosbeaks at their lunch counter. Eighty birds consumed one hundred and thirty pounds of sunflower seed during their winter stay at the Williamstown hostelry.

During the winter of 1941-1942, New England was literally "invaded" by thousands of the grosbeaks, some eighty of whom made themselves completely at home at John Treadway's lunch counter at the Williams Inn.

The Farmer Takes an Owl

By CHARLES W. GROFF

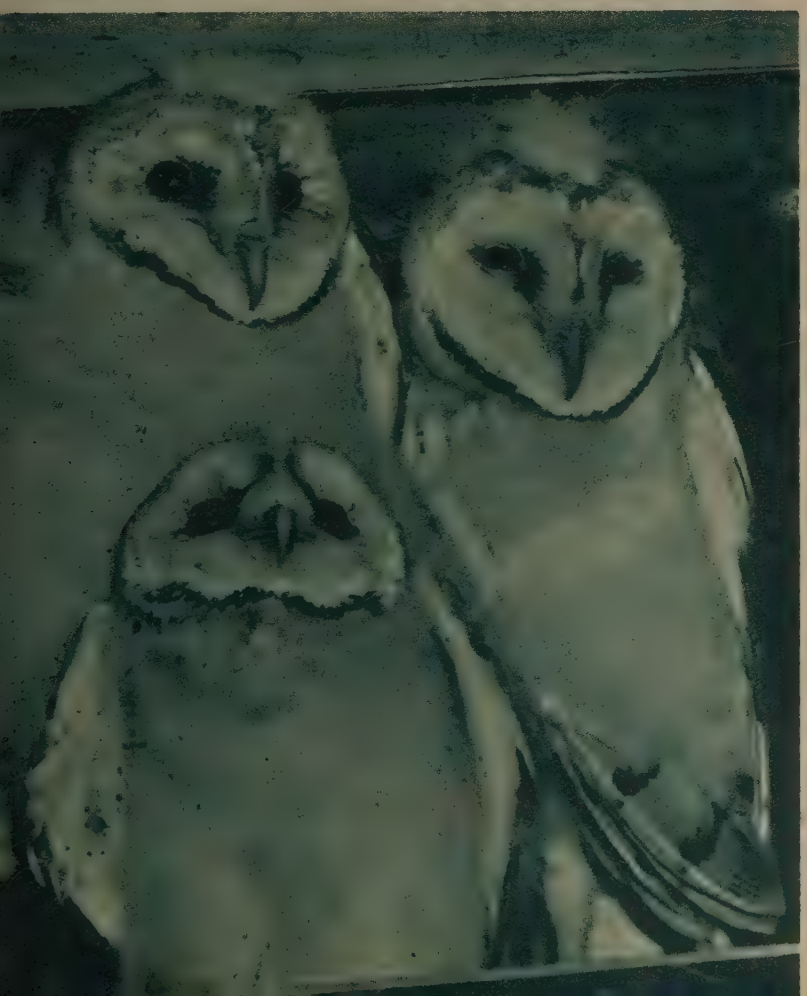
Hollowed by age, insects and decay, the ancient willow that stood in front of the Garbers' farm in Lancaster County, Pennsylvania, had fallen in a heavy storm. Thus was upset the life of a family of barn owls that found the old, hollow tree an excellent home site. Farmer Garber, however, knew well that these owls are valuable assistants to have around any farm. Graphic evidence of this is to be found in the picture of the mother bird caught in the act of bringing a toothsome mouse to her three young. So every effort had been made to save the trio that had survived the storm, three others having been killed when the tree was blown down.

My introduction to this roadside drama came as I saw Mrs. Garber peering into the hollow. Sensing a picture, I stopped my car and found that she was checking up on three screaming, hissing and snapping young barn owls in an improvised box nest. Getting out my equipment, I recorded the death of the tree, and, from above, took a picture of the three babies while they glared at me with their bright eyes in their three disk-like faces.

Mrs. Garber said that the mother owl recovered from the storm and had overcome her timidity and suspicion of the new home. She was now on duty nightly bringing food to them. Thus there was still another picture to be taken to round out the story of the owl family.

A few nights later I returned to try a night shot by releasing the shutter with a long cord. It was difficult to follow the arriving flight of the bird and my only reward was a part of the bird on the film. Bound to get a picture, I came back a few nights later, rigged a network of threads that were all joined to a main cord. This ran to a mouse trap trigger, and, in turn, to the shutter release.

From a few hundred feet away I watched and waited. Suddenly there was a silhouette of the mother bird against the night sky. It was only a second or two afterward that a blinding flash told me that the picture had been taken. Suspense always follows such an attempt, however, and it was not until, back in my darkroom, the sharp picture of the mother and the mouse appeared on the negative that I knew I had been successful in proving Farmer Garber's wisdom in his hospitality to the owl family, which certainly "paid its keep."



The Pasque Flowers, according to Dakota Indian lore, explained that their mission in the world was to tell the people, by their appearance each spring, that the buffalo would increase, and there would be plenty of food and clothing. This message would come through the children who would pick and admire the flowers, and then the boys would know that the time had come for them to practice with their bows and arrows.

Later in the season, when the flowers faded, and the ripened seed pods were topped with their plumy crowns, like the whitened locks of old men, it was a warning to the people that they, too, must become old and pass on to the other world where their ancestors had preceded them, and that there they should be reunited. Then the flowers promised to return every spring, and repeat their message of hope to each generation of men.

The range of the Pasque Flower in America extends from our northern plains northward over most of the Mackenzie Valley and westward over the drier plains of British Columbia. In the Alaska region it is represented by a closely related and very similar form, and others are found in northern Asia and Europe. The great Linnaeus, who described the original species under the name *Anemone patens*, probably met with it in Lapland. Later when the American form was discovered it was named *nuttalliana*, a variety of *A. patens*. Other specific names are *hirsutissima*, in allusion to its hairiness, and *pulsatilla*. Also, many authors now refer to the American plants under the genus *Pulsatilla*. So it is no easy matter to locate the plant in botanical texts, unless one bears in mind that it is an anemone.

However, under whatever book name, or under no name, one may find the blossoming plant itself, it is easy to understand why our native Americans gave it reverence, and wove it into the fabric of their legends and folklore, for it charms itself into one's heart.

On April 15 the blossoms are partially closed—the "tulip" stage. The leaves have opened and their stems have lengthened. On April 17 the petal-like sepals are beginning to dry, and the seeds are developing. Three weeks later, on May 9, the leaves have developed and form a dense clump. Now the seeds are nearly ripe, and the seed pods are ornamented with the long, hair-like, plumose styles. Now it is the old man of the Dakota's story.

The Pasque Flower

By EDWARD A. PREBLE

Photographs by Myrtle Biggs

What the trailing arbutus is to the people of our northeastern states, so is the Pasque Flower to those of the plains region. So also was it cherished by the native tribes of our high plains and to the northward. Because of this love for the flower by the tribesmen, and the white settlers who now occupy their lands, the Pasque Flower has been adopted by South Dakota as its State Flower.

To the late Melvin R. Gilmore, sympathetic student to Indian folklore and competent botanist, we are indebted for most of the evidence that indicates the reverence paid by the red man to this lovely flower. As he says, it is the earliest to put forth its blossoms in the spring-time, and often appears to gladden the bare brown hillsides with its bluish-purple bloom before the snow has melted in the spots where the deep shadows lie. The Pasque Flower is hairy all over, and the Cree Indians, commenting on this characteristic, say: "It is a brave little flower, for it comes so early in the spring-time, while the weather is still so cold that it must wear its fur robe."

The people of the Dakotas have a number of charming folk stories about the bloom. In the long ago, they say, whenever any of the people passed near a blooming clump, the flowers tried to show the friendliness they felt by nodding their heads in the chilly spring wind, showing their smiling faces and saying, "Good morning! Good morning!" But the people passed them unheeding, and the flowers became downcast by this cold indifference. So nowadays they bashfully turn their heads as they nod and call their kindly greetings in their sweet low voice. Although rebuffed, they still feel affection for human beings.

These photographs of a selected plant growing at Beynon, Alberta, and taken at intervals through the flowering season, show well its seasonal development. First on March 31, when the buds are just showing through the withered grass. Next, April 6, after a cold week, their stems have lengthened. Two days later, one has opened partially, and all are showing color. On April 11 all the flowers have opened, and the leaf buds are just appearing.

Our common toad, widespread, beloved, and in most of North America the representative of "the toad" of legend and folklore, is shown here in his singing pose. Our classical writers have not been kind to him, although Shakespeare credits the toad with wearing "a precious jewel in his head". The gardener usually recognizes his worth, but may not identify the sweet trill coming from the flooded swamp, or even know that but for this trip to the water there could be no new crop of toads. The photographer has caught this particular performer on land.

Lately, from his winter rest in the bottom of a spring, this leopard frog shows well the distended lateral vocal sac. The usual call is a guttural croaking, a long single note followed by a few shorter notes, sometimes given from under water. This is one of the most confirmed wanderers. (Both photographs by George A. Smith.)

The green or spring frog is most like the bull frog, and is not distinguished by most persons. Usually the throat is yellow. Like the bull frog, it passes the winter in the water or mud, sometimes in the flooded burrow of a craw fish. It is a late breeder, usually not laying until mid-June, and the tadpole does not transform until the next summer. The voice is a deep-toned twang, sounding as if made by a coarse rubber band stretched across a box. The voices of the younger frogs are higher pitched. (Photograph by Gehr.)

Here we see the spring peeper, and, at the right, the common tree frog (photographs by George A. Smith), both about twice enlarged. The peeper, about one inch in length, has lived all winter in the earth, usually deep beneath a carpeting of leaves. The tree frog in winter goes down among the roots of a stump, or, perhaps more commonly, burrows in the decayed wood in a tree hollow, sometimes high above the ground. Each shows well the expanded throat bubble that helps to carry the voice for long distances, especially in the still evening air.

A clear, sweet, shrill, piping whistle, a double note many times repeated, may continue a minute or so, hundreds singing at once.

The common tree frog emerges later, seldom before May, and usually lays its eggs in a temporary pool. The note is a slow soft trill, not regularly-spaced, that reminds one of the call of our red-bellied woodpecker, and is most commonly heard from the trees, after the breeding season.

The loud, guttural voice of the bull frog, which may carry for a mile in the still air of evening, is becoming a rare sound. It is commonly thought to sound like "jug-o-r-r-r-rum", or "better-go-round", and while not musical, it seems singularly in keeping with the usual time and place. The bull frog remains two years in the larval stage. (Photograph, somewhat reduced, by F. S. Gehr.)

SPRING SONG—A prize-winning study of a singing toad in spring by Philip B. Mansfield of Buffalo, New York. It was chosen second-best in the 1942 Annual Salon of Nature Photography of the Buffalo Museum of Science.

Voices of Spring

By EDWARD A. PREBLE

To the Nature-minded country resident of our eastern states the spring songs of the frogs and toads are almost as welcome as the chorus of the birds. However, few know that the earliest of these amphibian songs come from species that have passed the winter on dry land rather than beneath the water where they sing. They are first heard from pond or swamp because they are led from their underground hibernation by the same instincts that prompt them to give voice to their emotions in the element where their eggs and helpless young must find congenial surroundings.

Among the earliest to greet us are the spring peepers, the swamp tree frog, or chorus-lover, the wood frog, and one or two toads. The toad voices are especially musical, and, by the uninitiated, the singers are often thought to be frogs rather than the common friend of our garden and dooryard. Later come the spring and leopard frogs, the common tree frog, and, last of all, the bull frog. These are the common and more wide-ranging species of the eastern states.

Besides these, several beautiful and interesting small frogs are confined to our eastern and southern coastal swamps. West of the Rockies are several species not closely related to those mentioned, but the arid and semi-arid regions have produced smaller variety. Another group, the spade-footed toads, which spend most of their lives below ground in sandy districts, have representatives the country over, but they are rarely seen.

Nature in Print

By HOWARD ZAHNISER

As THE season returns when we may once more expect a national gathering of conservationists and another observance of national Wildlife Week, it is indeed encouraging to note that there is no end yet to the publication of books on the natural resources of America. The war, says Richard Lieber in his newly issued work on *America's Natural Wealth*, has "placed additional responsibilities on all of us, but battles are fought not only on land, sea, and in the air, not only by correlated battle lines and production lines, but by the devotion, determination, and consecration of a whole people." It is, in my opinion, a credit to the publishing firm of Harper and Brothers that through their facilities it is possible for Mr. Lieber thus to continue pleading conservation's case for a better world.

Addressing himself to conservationists surely, and preferably to all Americans, Mr. Lieber writes: "Let us be of good cheer and stout faith that through courage, sacrifice, vision, and kindliness we shall make our contribution to the end that our country remain . . . a land of promise, of opportunity, of freedom, and of sunshine." It is an exhortation that will apparently be always timely and one that is most assuredly so in a year as critical as 1943 now appears to be—not only for conservation but also for the natural resources it hopes to guard and for the nation.

How urgent such pleas have been in the past will be obvious to all who will read Mr. Lieber's review of facts and developments—a summary that is appropriately subtitled "A Story of the Use and Abuse of Our Resources." Both aspects of his treatise are somewhat familiar, yet anyone's understanding of either will be the better for a perusal of this book. Its concise accounts of the progress so far made against abuses are incentives to continued vigilance. Its emphasis on the values of the resources for which we are contending is even more inspiring. As Mr. Lieber says of the not-yet-written "great epic of America" so we might also say of his own work: "We shall gain [from it] a new comprehension of the native richness of our land and of the support our great natural resources were to the pioneer and the settler, as they are to us today in their remaining forms, and as they will be to those who follow, *conservation prevailing*." The italics are mine.

Richard Lieber, who has been active in conservation since 1912 and was director of the Indiana State Department of Conservation from its creation in 1919 until 1933, writes what he describes as "nothing not already known by close students of conservation," yet it must be a certainty to him by now that any such statement of conservation's needs is important if it reaches an audience. He declares it his purpose "to attract the interest and to arouse the fighting spirit of intelligent laymen and laywomen on behalf of the great cause of national conservation. This movement today," he affirms, "has become one of the most active forces for human betterment," and undoubtedly he realizes how great the obstacles are to such a movement in time of war. It is strongly to be hoped that such efforts as those of Mr. Lieber and his publishers are rewarded by the American readers who still have a mind for the future.

"Militant public opinion would soon be aroused," says Mr. Lieber, "if all could visit the still marvelously-clothed mountains and hills of our Far West." It is a suggestion that I am sure would be supported by the geographer, Roderick Peattie, with the added comment that it would not, however, be necessary for Easterners to journey to so great a distance as the Far West. At least this is a reasonable expectation by one who has just read *The Friendly Mountains*, the first of a new series of mountain books which Mr. Peattie has written in part and edited for The Vanguard Press. Dealing with mountains of the Northeast—the "low and venerable" Taconic Mountains, "perhaps the oldest range in America"; the "more rugged" Green Mountains of Vermont; the "higher and wilder" White Mountains of New Hampshire; and the Adirondacks of New York—*The Friendly Mountains* brings to its readers the inspiration that Richard Lieber covets for all his fellow countrymen. One of its authors, Louis B. Puffer, a professor of civil engineering at the University of Vermont, brings even to the fireside at home what I take to be the very spirit of mountaineering when he writes:

"And finally, to get into the wilderness at intervals is good for a man's soul. Petty cares and troubles . . . fade into the background when one stands on a high summit, attained by one's own effort. . . . The fresh breeze of the mountains and the clean odors of the forest wash away the dust of worry and mental depression, and kindle the spirit."

Such are the experiences that are central in the altruistic hopes of many of us who are advocates of conservation. *The Friendly Mountains* not only entices its readers to these enjoyments, but also provides a practical guide to their realization and enriches the understanding of all who may respond. Its contributors include Zephine Humphrey, a writer of Vermontana; Robert Balk, a professor of geology; Dr. Victor Conrad, a meteorologist; Dr. Hugh M. Raup, of the Arnold Arboretum; Katherine Toll, who "has skied every run from Maine to Sun (Continued on page 164)

"... the fire balls raced along the ground and even climbed poles supporting the telephone wire running from station to station."

Eerie Lights

By W. L. McATEE

Illustrated by Lawrence D. Conway

One of the definitions of eerie is given in its rhyme skeery, but whether the natural lights here considered are skeery or not depends much upon one's introduction to them. Mine was on a grandfather-guided foray amidst the Hills of Somerset (beloved and celebrated by James Whitcomb Riley) which, with enthusiastic anticipation, we had visited in the hope of fishing in strange waters. Painful it is yet to recall that after dark mosquitos made life so miserable for us that we gave up and started back home. That is why I was awake at the proper time and place to have one of Nature's lights pointed out to me. It was in a decaying log in low ground along the river and was called fox-fire. It was a pale yellowish, steady glow, that did not seem alarming and evidently was not so regarded by the venerable friend and guide of my boyhood.

On the other hand, an acquaintance of later years told me of an experience with moving lights that gave him a distinctly uneasy feeling. He was a young man at the time, just old enough to substitute occasionally for coast guardsmen temporarily off duty. Part of the job was to patrol an uninhabited outer beach where, on the four-mile stretch between stations, a man might find himself out of sight of human habitation and, as to moral support, entirely on his own. On this very beach, inside the great Hatteras shoals, upon which so many vessels have been wrecked, my friend had recently helped to bury the sodden, pallid corpses of a whole ship's company. When, therefore, balls of fire appeared to him at night on his lonely patrol, it is no wonder that they aroused certain misgivings, accompanied by those cool, crinkly, twitchings of the back muscles that are popularly referred to as shivers running up and down the spine. When the fire balls raced along the ground and even climbed poles supporting the telephone wire running from station to station, it was almost too much, but duty prevailed, he must meet the patrolman from the next company at the appointed place, and he did. But, he admitted, he felt creepy.

"Lantern birds . . . were barn owls . . . their feathers smeared with light-giving fungi growing in the tree cavities . . ."

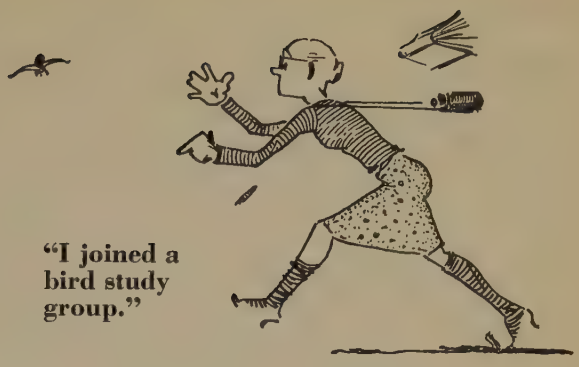
That others have felt the same about the lights is shown by some of their popular names as: corpse candles, corpse light, dead lights, and death fire. Their appearance has widely been regarded as a portent of death. A little less apprehensively, they have been called elf candles and elf fire. The moving kinds, in particular, have done men's souls no good, and while the names they have inspired lack the repellent words of the terms just mentioned, they have implications that are far from reassuring. Will o' the wisp is a common designation and others are Jack o' lantern, Jack lamp, Kit-of-the-candlestick, and Wat. Few desire close acquaintance with these mysterious characters, who are less definitely referred to as Lampmen and Lantern Men.

Both those who have, and those (Continued on page 160)

I Become a Bird Watcher

By HARRIET CULP

Illustrated by Lawrence D. Conway



"I joined a bird study group."

I WAS once a happy, care-free Nature lover. I loved the woods, the meadows, streams, trees, flowers and birds. Perhaps I should have been content to remain as I was. Would it have been better to walk in the woods and listen to the songs of birds, never trying to learn whence came each rapturous melody? Should I have been satisfied to watch their darting flights, to catch glimpses of bright colors, serene in the reflection that I could recognize the robin and cardinal? But I would not let well enough alone. I joined a bird study group.

What now to me "the long reaches of the peaks of song, the rift of dawn?" Once I awakened light-heartedly on spring and summer mornings to the early concert of birds. But now a thousand questions torment me as I listen. Was that the Maryland yellow-throat? The warbling vireo? The yellow warbler? Even as I leaf swiftly through my field book in search of descriptions that may fit the songs I hear, a fresh confusion of melodies breaks on my bewildered ears. House wren? No, no! Song sparrow? I wait for the three clear notes that announce his composition. (I am maddened by the thought that Donald Culross Peattie can lie a-bed and identify each chorister.)

". . . now I must carry field glasses, a textbook, paper and pencil."

Trying to become an ornithologist has changed my whole life. I waste time. I forget what I set out to do. I go to the window to see if the postman is coming, intending to return to my typewriter immediately. But there is a bird on a dead branch in our maple tree. Do chewinks perch on dead branches? No, they rummage among dead leaves. Anyway, this is a small, grayish-brown bird. Wood pewee? But a pewee is not supposed to wag its tail. Might be a phoebe. I hurry out with field glasses to look for wing-bars and eye-rings.

The trouble I have in distinguishing birds by their appearances fades into insignificance when I run up against their songs. The bird people, on our Sunday walks, stroll along listening and smiling knowingly, nudging me in the ribs at each new call.

"Field sparrow," they whisper. Or, "chickadee. Summer tanager. Do you get it?"

One of the walkers frequently grabs my arm at a bird sound and cautions the others to be silent.

"Listen to the towhee!" she says, cocking her ears to one side in an effort to assist *my* hearing. "It says *Drink your tea-a-a!*"

The others nod and smile and look at me expectantly.

"Doesn't it say *Drink your tea-a-a?*" they ask.

It does not to me. Sometimes I tell them I hear things so they will believe I am catching on. Sometimes I stick it out and they start giving imitations of bird songs and arguing among themselves. They end by urging me to go out in the woods every day to observe and listen.

I used to enjoy walking in the woods. But now I must carry elaborate paraphernalia—field glasses, a textbook, paper and pencil. I feel encumbered and awkward. The glasses thump me at each step. My neck hurts from looking up into branches and my eyes smart from the sun. But the club members complimented me when I reported one Sunday that all alone I had identified a kingfisher.

While I build up prestige with the bird people I am losing out with my old walking companions. They no longer wish to stroll with me. They do not care to be brought up short by a sharp, whispered command to halt while I whip out field glasses. It irritates them to be asked to jot down identifying marks while I creep Indian-like beneath the trees. Continuous conversation is impossible and they do not like to have their long-winded stories interrupted with:

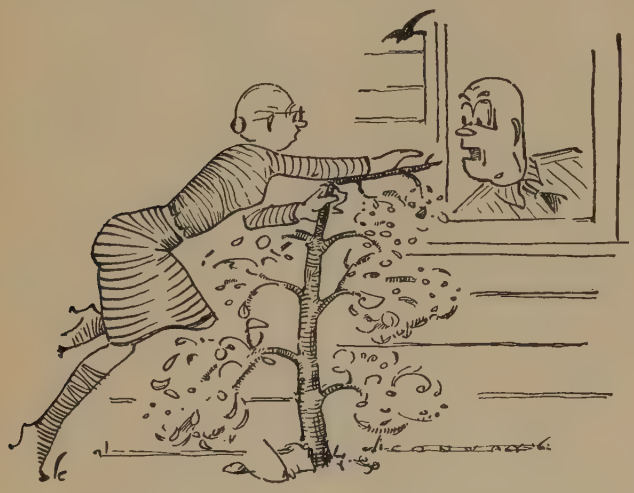
"Sh-h! I think I hear a ruby-crowned kinglet. Does that sound like *Tee tee tee, tew tew tew, tee diddle, tee diddle, tee diddle?*"

"I didn't hear anything at all," whoever is with me remarks. "You've got a wonderful imagination. Just like I told Mrs. Ursel it isn't fair for some of us to do all the work and have that—"

"Keep quiet just a minute," I say. "Get the book out and look up horned lark."

However, if I am tiresome to these lay friends they are often very provoking to me. They describe *rare*

birds they have seen and ask me what they are. But they always refuse to accept my identifications. One told of seeing a beautiful specimen which she was sure was unknown even to Audubon, as it was not in his book. She described it as small and black with yellow in its tail and wings.



". . . if I am haled into court as a Peeping Tom . . . the bird club will stand back of me solidly."

"You should have seen the way it spread its tail fan-wise," she said. "It was gorgeous! I'm going to write the Audubon Society."

"Did this small bird dart about in sprightly fashion?" I asked.

"Yes."

"It was a redstart. We watched one last Sunday."

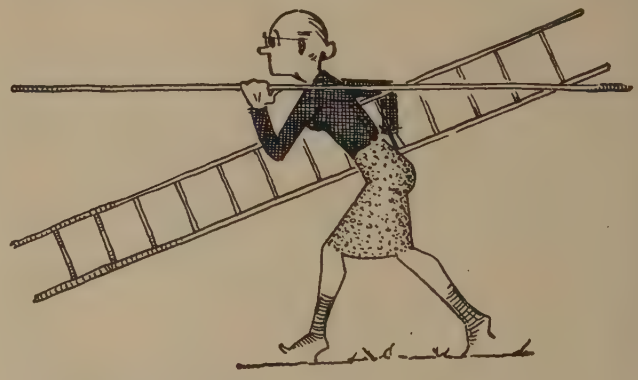
"Redstart? Don't be ridiculous. I told you the bird was yellow and black."

Useless for me to explain that the male and female were colored differently, or to get the book and read the description to her. She said she knew very well the difference between olive-brown and black and she did not believe everything just because it was printed in a book. She ended by telling me that if I had spent as much time in the country as she had I would not need to join a bird club to know birds.

My neighbors, too, have become peevish with me for I notice that even though the weather is pleasant they pull down their shades when I stroll around my grounds. However, it is only because I am trying to see the central breast spot on a song sparrow, or the yellowish under-parts of the Philadelphia vireo, that I come closer than usual to their shrubbery. I do not wish to look in their windows, but if I am haled into court as a Peeping Tom it is a comfort to know that the bird club will stand back of me solidly. Added to this, I have angered several small boys who live close at hand by threatening them with all the penalties of the Federal law if I catch them shooting at birds. One urchin, caught red-handed with bow and arrow aimed at a cardinal, fled like a rag on the wind as Freddie did in *Seventeen,* at my suggestion that I would report him to a mythical society for the prevention of cruelty to birds, quoting an imposing name.

I used to have time to read a lot. Before I became a bird watcher I had started *War and Peace.* But I returned it to the public library, for now I spend my spare time reading bird books. I bought Peterson's *A Field Guide to the Birds,* and someone gave me Audubon's *The Birds of America.* In fact, nearly everyone I know has thoughtfully given me a book, figuring of course that I would need one. My library includes Carr's *Glimpses of Familiar Birds,* the National Geographic *Book of Birds, Birds* from the Little Nature Library, Reed's *Bird Guide,* and *Birds of Minnesota* by T. S. Roberts. This last I have had no occasion to consult as I do not expect to be anywhere near Minnesota for some time, perhaps never. In my reading I come across other suggestions and I am constantly jotting down names of more books, such as *Study of Song Sparrow,* by Margaret Morse Nice, published by the Linnaean Society of New York. In addition, the club members lend me books by John Burroughs and Donald Culross Peattie.

The bird club meets on Sundays. We assemble at six-thirty and walk and watch for two hours. I am going to learn about birds if it kills me, but why anyone should choose Sunday for an early stroll is a continual mystery to me. After Saturday night, I yearn for sleep. I tumble out of bed in a half daze, drink a hasty cup of coffee and join my companions. They all look fresh, robust and well-rested. They greet me with hearty accents and pleasant little quips and cracks. I straggle



"I picture myself with a ladder and long pole . . . often mistaken for a tree surgeon."

along for the first half-hour mumbling replies with a poor grace. Six-thirty is early to be out any morning, but on Sunday it is madness.

Naturally, anyone who spends as much time studying birds as I do eventually learns something. I speak to my lay friends of upper and lower mandibles, lesser wing coverts, tertials, rumps and wing-bars. I mention the *stout, finch bill* of the cowbird, the *rufous* cap of the chipping sparrow. In my first months of bird watching I learned to identify twenty-four by song and sight and sixteen others by sight. This sounds impressive to relatives and friends, who probably do not realize there are hundreds more. But it is wonderful to know that it is a yellow-throat that is singing *witch-*

ity, witchity, witchity, and a Carolina wren calling *wheedle, wheedle, wheedle.* I am anxious to hear the olive-sided flycatcher with the spirited song of *hip-three-cheers! or hic-three-beers!* The happiest song I know is the yellow warbler's, and the most melancholy the wood thrush's, a bird rendition of *Dover Beach.* I have never heard a hermit thrush, which Peterson describes as "unimaginably lovely."

Once, even my dreams were peaceful. But now I race through deep forests pursuing birds with my field glasses. My dream birds are not like any I have ever seen and it is agony not to be able to identify them. They are always beautiful and usually have top knots. And through my troubled sleep runs the refrain: the titmouse is the only small, gray bird with a crest—Peterson.

It is all very well to joke but I get a little desperate when I contemplate the gulls and terns, the herons and spoonbills, the mergansers and kites, the ospreys and falcons, the pheasants, rails and limpkins, the snipes and sandpipers. When I master the birds in my own territory shall I ever learn to identify the harriers, the storks and wood ibises? I shall not be able to loll around in the sand when I go to Florida on vacations now. I must seek out Audubon's caracara. Its under-surface presents three alternating areas of light and dark. And there is the Florida gallinule, a gray, duck-like bird with a red bill. But they tell me that *Florida Bird Life* by Howell is a wonderful book.

However, there is no use for me to worry about great white herons and least bitterns now. I have all I can manage for the present. In addition to watching birds, most of the club members have collections of nests that they gather during the winter. They make the search for nests sound so important that I shall have to do the same. But what of the future? I picture myself with ladder and long pole, deserted by former companions, a stark, lonely figure silhouetted against the winter sky, often mistaken for a tree surgeon.

I know now how Wordsworth felt when he wrote his *Intimations of Immortality.* For to me, too

"There was a time when meadow, grove and stream,
The earth and every common sight,
To me did seem
Appareled in celestial light,
The glory and freshness of a dream.
It is not now as it hath been of yore;—"

Now, a meadow is a place where I may find blue-gray gnatcatchers. By a stream I must seek the Louisiana water thrush. In a grove are the forty-two wood warblers. Every common sight, even insects and dandelions, is connected in my mind with certain birds. The songs of dawn that had the glory and freshness of a dream clamor to be identified.

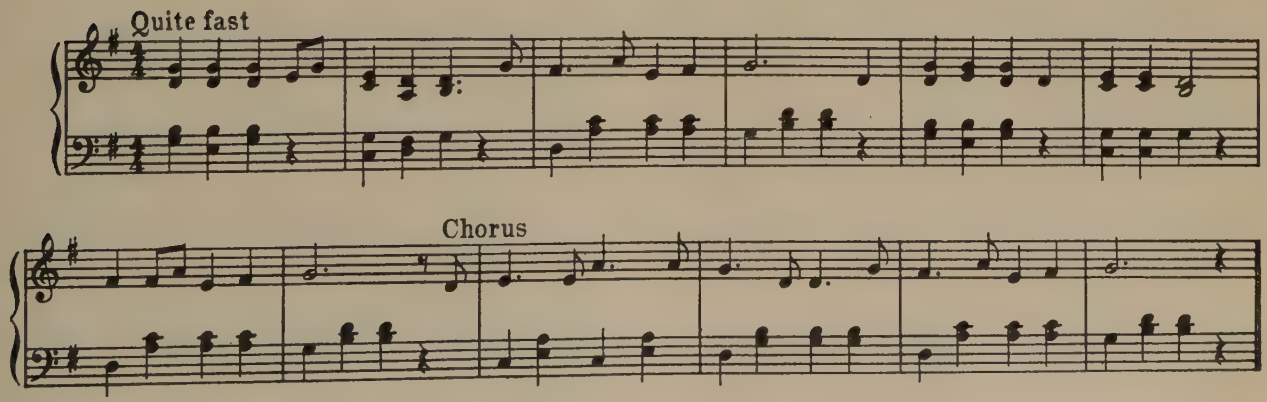
But I would not go back to my former state. A whole new world has opened up for me. Who knows? When the day comes when I can call myself an amateur ornithologist I may be tempted into other bypaths. There is a lot I have been missing. Nature surely can open many more doors for me. I must get busy.

★

Old Raccoon

Words and music by GRACE KEIR

Reproduced from "Songs of the Open" by special arrangement with the publishers, Carl Fischer, Inc.

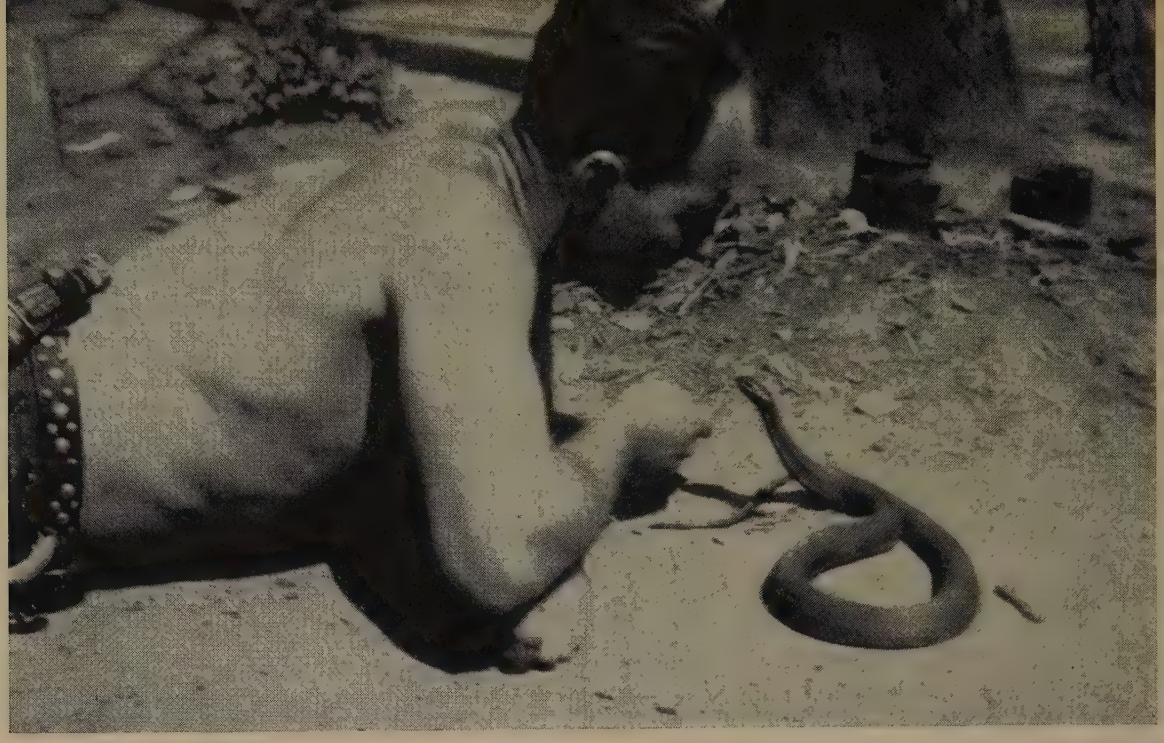


Him they trailed to an old bass tree
That leaned across a brook,
And not far up a hole was seen,
A cozy raccoon nook.

Chorus:
"Aha!" said he, "You'll not catch me,
I'll win this race for life!"

Trapper said, "Let's smoke him out!"
To smoke him out they tried,
But raccoon slipped through a hole he knew
And thus their plans defied.

Chorus:
"Aha!" said he, "You'll not catch me,
I'll win this race for life!"



Making friends with a red-bellied water snake, which seems to be in a friendly mood. This is one of the best snakes to keep as a pet and for observation.

To many people a snake is a snake, but this is because they have never kept—

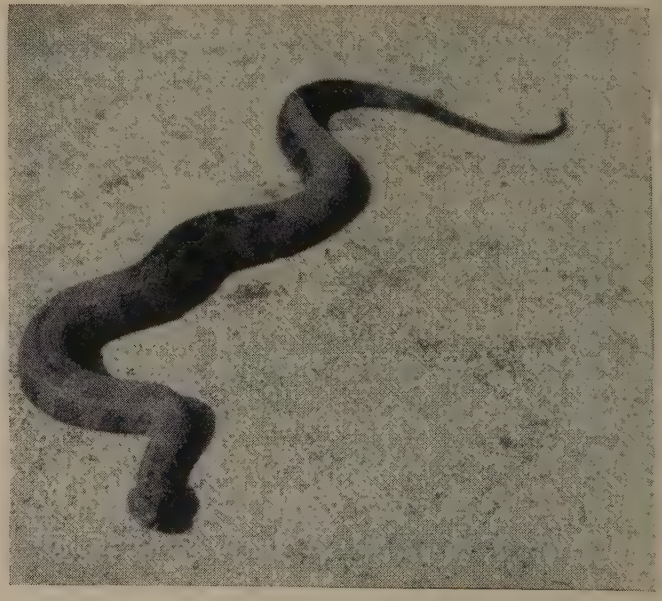
Harmless Snakes as Pets

By HERBERT ELLISON MITCHELL

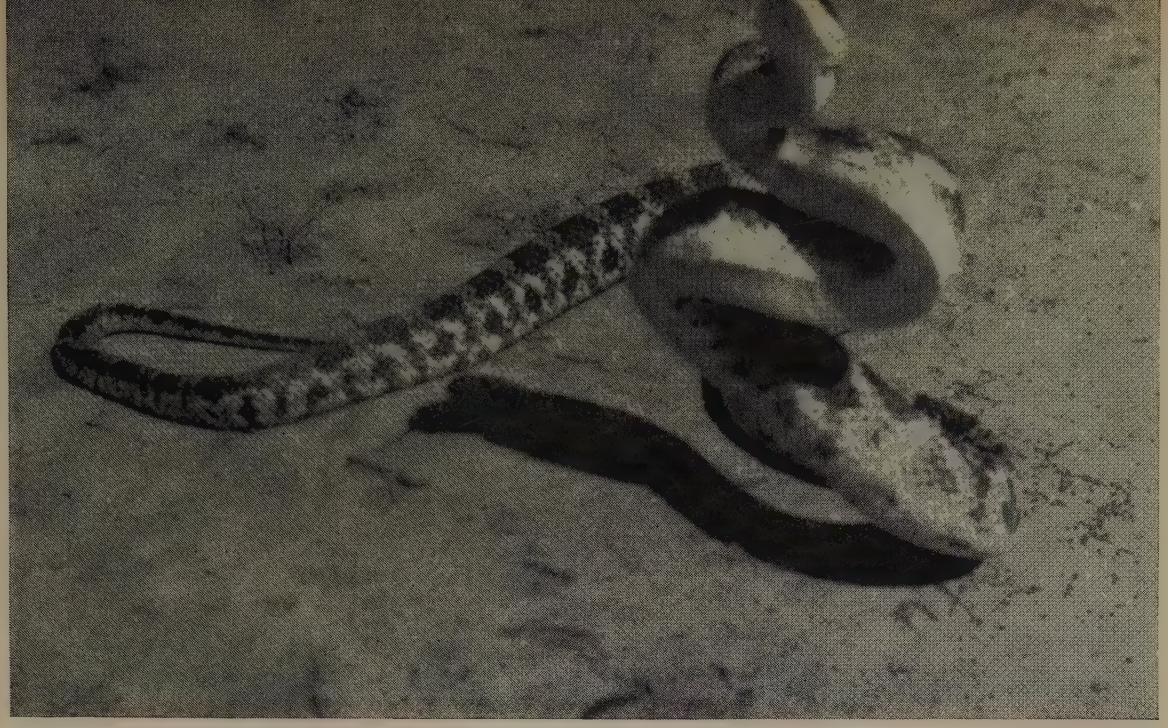
SUNNING himself on a rotting log half-submerged in the coffee-colored water, his roughly-keeled scales glinting in the sunlight, was a huge red-bellied water snake. Apparently unaware of our approach, the snake lay with his long head, eyes far forward near the nose, facing away from us and looking down towards the water. Slowly we waded towards him through clouds of hungry mosquitos. Cautiously we advanced the long bamboo pole, tipped with a copper wire noose, towards the reptile. The snake raised his head. His black tongue flickered in and out rapidly. He sensed danger. Swiftly we lowered the noose until the loop was directly before his snout, then we carefully pulled it backwards. Mosquitos and sand flies had settled over our faces, necks and arms, but we gritted our teeth. Then the reptile drew up his tail and made a sudden plunge for the water. At the same instant we jerked the pole upwards and backwards, the wire noose pulled tight around the snake's neck and we had another fine prize for our nearly-filled sack.

Hunting for many miles along the river bank of the Santee River swampland in South Carolina, we had collected nearly a dozen fine water snakes, and one chicken snake that had crawled down to the river's edge to drink. We were then ready to turn homeward.

In South Carolina and neighboring states there are five species of water snakes. Largest of these is the big, ugly, brown water snake, which grows to nearly six feet and may weigh eight or ten pounds. I caught one



The brown water snake is often mistaken for the poisonous water moccasin, but it is not a dangerous snake at all.



A chicken snake coils to strike in a menacing manner that suggests a deadly reptile. Actually, however, this snake is harmless, valuable and makes an interesting pet.

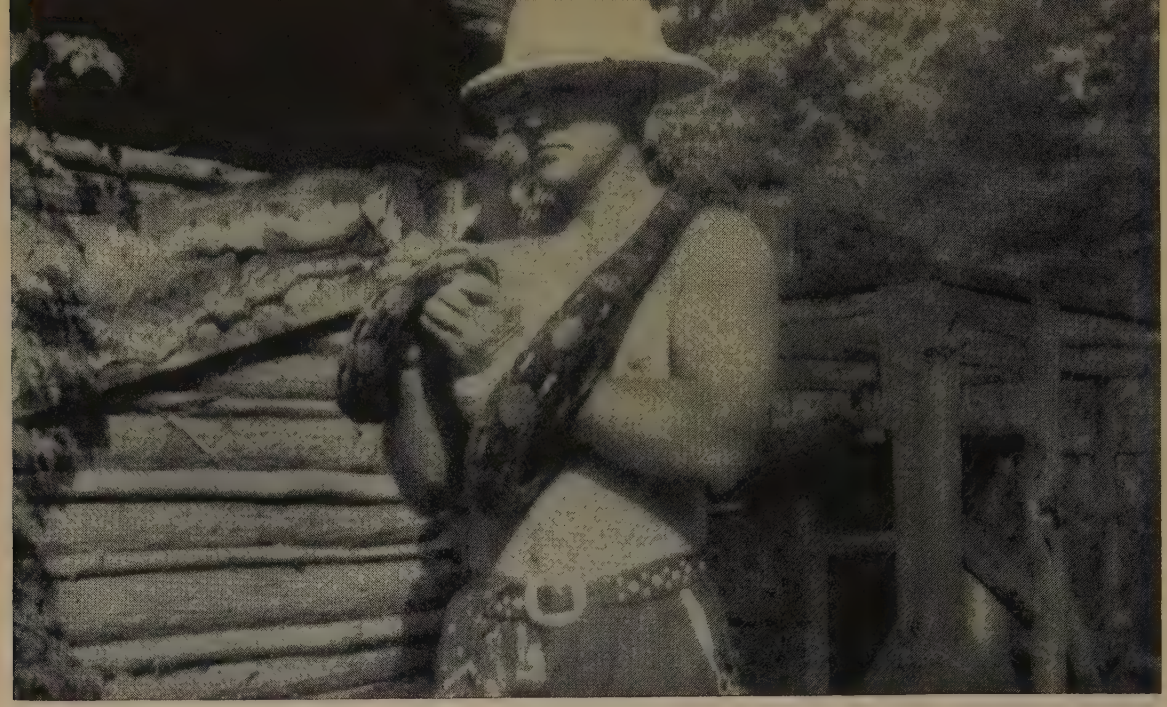
arge female in Santee Swamp exactly five feet, six nches long and weighing ten pounds. This snake ater gave birth to sixty-four living young. Dull brown r gray, it has rows of large darker-colored blotches long the back and sides, a long tail tapering to a point, nd a long head with eyes placed very far forward ear the nostrils. The lower jaw is narrow and long, urving inwards at the lips. This serpent is often misaken by the layman for a "water moccasin" or "water attler", and is believed to be deadly poisonous.

Forbidding as he may appear, the brown water nake is non-poisonous and, in fact, a timid snake, sually gliding or dropping from overhanging limbs into the water at the first appearance of danger. They feed almost exclusively upon fishes, cat-fish in particular. They rarely leave the vicinity of deep bodies of water such as lakes or rivers. They are not found along smaller streams, or "branches", as are the banded and red-bellied water snakes and the cotton-mouth moccasins. In captivity they make poor pets as they resist feeding and usually starve to death even though food may be all around them. Even baby brown water snakes are fussy about feeding.

Close-up of a red-bellied water snake. These reptiles usually grow to slightly more than four feet and weigh three to four pounds.

Among the harmless water snakes, the green water snakes are next in size, attaining a length and girth almost as large as the browns. These snakes, however, are not abundant, and in sixteen years of collecting in South Carolina I have found them only in certain abandoned rice fields along the Cooper River. The scales are keeled but not quite as pronounced as on the browns, and the body has a certain lustre or shine to it, not seen in the browns. The general shape and formation of the body and head are practically identical, however. They are also timid and difficult to feed.

The banded and red-bellied water snakes are the most abundant of all the water snakes, and among the best snakes to keep for observation and as pets. Growing slightly more than four feet long, and attaining a weight of three to four pounds, this serpent is extremely gentle when captive and will live for years with little attention, feeding regularly on a diet of frogs and toads, small fishes, tadpoles, salamanders and worms. I have kept many of these interesting snakes as pets and have been delighted with them. They have lived for years in ordinary wooden boxes with a front of screen wire and a pan of water placed inside for them to soak in occasionally. They are fed



The author takes a look at the teeth of a boa constrictor sent to him by a friend who caught it in British Honduras. Mr. Mitchell knows how to handle snakes.

about twice weekly on live frogs or toads; have bred in these boxes and given birth each summer, during August, to from twenty-five to thirty-five living babies, which have been successfully reared each season. The young feed voraciously on minnows and small strips of raw fish cut and placed in shallow pans of water in their cages. They grow fast, and in four or five years are fully grown.

The females of all these water snakes are always by far the largest and heaviest specimens. It is amusing in the spring to come upon a group of these creatures mating. Perhaps there will be a huge six-pound female surrounded by three or four males each only about two to three feet long and weighing perhaps two pounds apiece. The difference in size is most pronounced among the brown and green water snakes.

All these snakes are harmless and inoffensive creatures. There is, however, a very poisonous water snake—the water moccasin or cotton-mouth. The heavy bloated body, short stubby tail, roughly-keeled scales and heavy blunt head distinguish this reptile from his harmless relatives. The quality of the skin, especially when the creature has recently moulted, is like rich velvet. The ground color is a greenish-yellow with large irregular saddle-like blotches across the back and down the sides of a much darker color—sometimes black. The top of the head is covered with plates instead of scales, and the eyes are sunken, with a heavy plate protruding slightly over them. The pupils are elliptical, while the harmless water snakes have a round pupil. Between the eyes and the nostrils there is a deep pit or hole in each side of the head, the purpose of which is unknown to science, although it probably provides a sixth sense of some sort, perhaps helping to guide the snake in striking. The scales or plates under the tail are in two rows, while in the non-poisonous varieties they are in one row. The cotton-mouth also has an interesting habit of throwing the mouth wide open at the approach of a human, showing the clean white mouth parts and the pair of death-dealing fangs; hence the name cotton-mouth.

I have tamed these snakes and made real pets of them, but I do not advise it for others. Of all snakes they are the most hardy in captivity, feeding and breeding regularly for years, and appearing never to be subject to disease. These snakes are fairly abundant in the southeastern states, and I have found them everywhere where there is a pond, a swamp or a sluggish waterway overgrown with briars, weeds and other vegetation. They may even occasionally exceed the brown water snake in size. I have had individuals weighing up to nine pounds, but these came from the Everglades in Florida. The largest specimens captured in South Carolina weighed slightly more than six pounds, and were about five feet long.

Other beautiful snakes that make interesting pets and are easily kept are the chicken snakes and the king snakes. There are several varieties of each of these species with variations in color and size but the general pattern and habits within each group are the same. All are equally desirable in captivity.

The most common, and perhaps the best known, is the fine black and white king snake, growing six feet long and with a powerful, stout body. The scales are small and smooth, the neck the same size as the head, which is round with a pointed snout. The tail is of medium length. King snakes make beautiful pets and soon become used to their owner. They feed readily and are hardy in captivity. I feed mine mostly on other small snakes, and "glass" snakes and other lizards, with an occasional mouse when available. They need be fed only about once (Continued on page 160)

Restoring the Pond Lily

By EDWIN F. STEFFEK

THE white pond lily, *Castalia odorata,* is one of the most beautiful and most sought of our summer wildflowers. Floating on the water, its charming, fragrant, waxen-white, four- to six-inch blooms and lustrous round leaves have been the object of many a boat ride. Countless plants have been ruthlessly pulled up to satisfy the human desire for the exquisite. Besides bearing beautiful flowers, the pond lily's blooming season is long—too long for its own safety—extending from June through August and sometimes into September.

The plant is, of course, aquatic and delights in warm, shallow ponds and slow-moving streams, where the water is neutral or a little on the acid side. It grows from a thick more or less horizontal rootstock, and was once plentiful from Newfoundland to Manitoba, and south to Florida and Louisiana.

Fortunately, white pond lilies are easy to propagate. Where conditions are to their liking and they remain undisturbed long enough they may even become so crowded as to interfere with their flowering. The quickest method of propagation is simply by division of the thick rootstock into as many sections as appears advisable upon inspection. However, when the seeds can be obtained—and they should not be left out of the water too long—it can also be increased by merely encasing the seeds in a ball of clay, or a paper bag full of soil, and dropping them into the soft mud where the water is not much less than two feet or much more than four feet deep. Such places favor germination.

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Not So Natural

By WILLARD HALLAM BONNER

LITERALLY the word "nature" has to do with being born (*natus*). It has to do, therefore, with the *essential, inner* character of things. Yet another meaning probably dominates all others today. This is as it is used on the cover of this magazine, meaning the external phenomena of the universe. But in the big library dictionary this present-day meaning is tucked away in the middle of a whole column of fine print where it is meaning number "6". There are eleven other distinct meanings. Worse yet, if we count all shades and subdivisions of meaning, there are in all twenty!

It would therefore be possible, although not commendable, to carry on a conversation that would confound the hearer and run like the following:

"The nature of my nature-talk today has been a little unnatural," said the lecturer. "Are there any questions?"

"Don't you think spiritual natures are naturally inclined to get more out of Nature?" asked Miss Moon.

"The Divine Nature moves mysteriously, Miss Moon. Unnaturally depraved natures are dead to this inner nature of Nature, but even they are awed by the austere face of Mother Nature. On the other hand, sheer nature in the hearts of good men, in a simple state of nature or refined to the highest in human nature, draws them to the Great Artist. And after all, what is art but the perfection of nature."

Spanky Is A Groundhog

By MARYBELL McCURDY

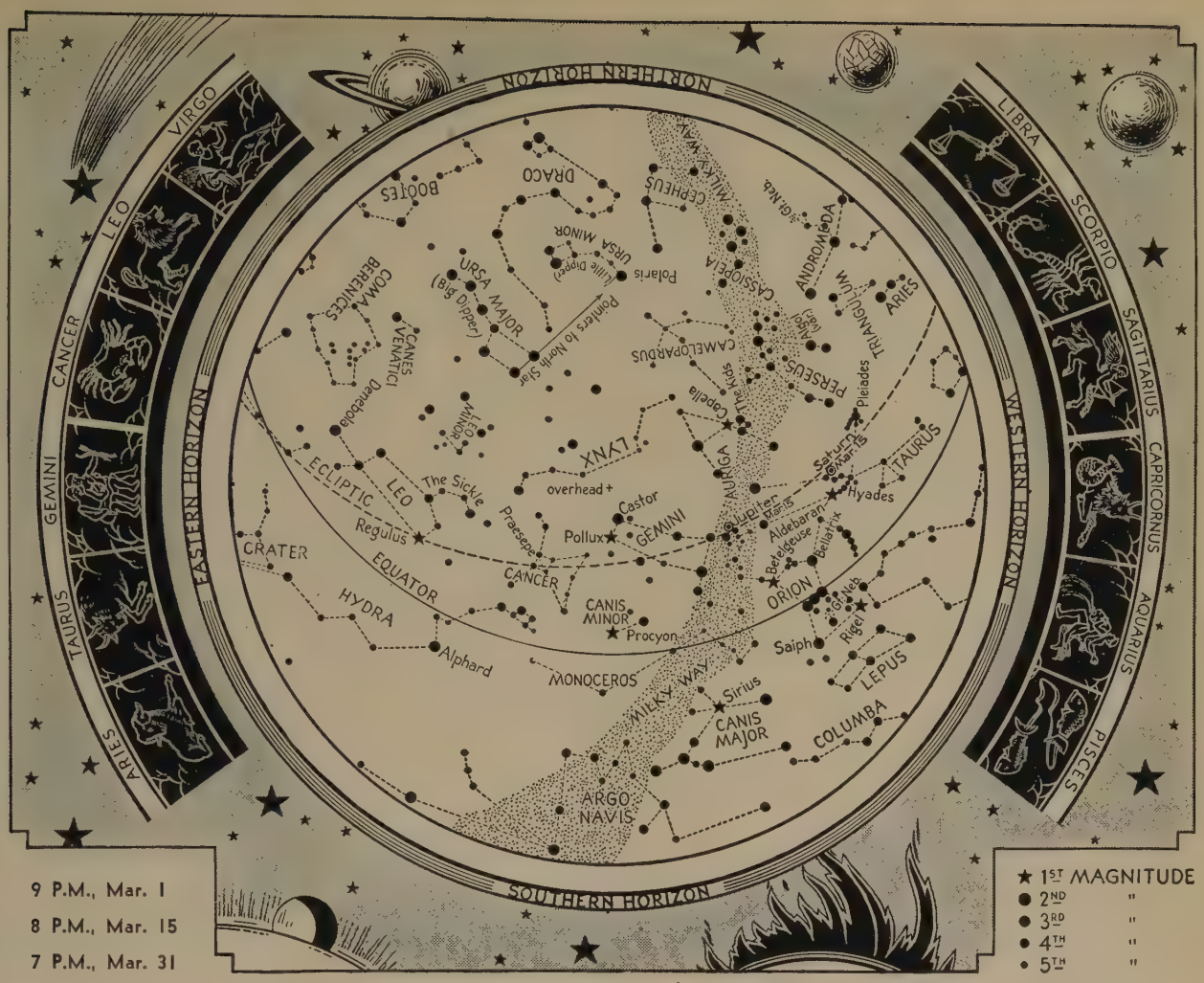
His name is Spanky Groundhog. More than four years ago we found him, almost starved, beside the body of his mother, who had been shot by a hunter. We gave him a warm bed and fed him milk from a medicine dropper. He grew rapidly and soon exchanged the dropper for a small bottle. He then began to eat graham crackers, which have remained a favorite item with him. In early spring he eats carrots, cabbage, lettuce and celery, but these are scorned when wild greens such as grass, clover and dandelion are available.

We supposed, when he was able to shift for himself, he would leave us for the wild. But not Spanky! During his first summer he roamed the woods at will, and dug hole after hole in which to hide, but several times a day he would wander in for his tasty graham crackers. Came fall and he started carrying leaves for his winter hibernation. This preparation for winter was a lesson in industry. He would rake together a pile of leaves, then would start cramming them with both paws into his mouth, all the while keeping an alert eye for danger. He could stow away an astonishing amount of leaves. When loaded to capacity he would run for one of his numerous dug-outs, soon to return for another load. Then, one cool windy day, he disappeared. "Now," said we, "that is the last of Spanky, for by spring he will have forgotten us entirely." But back he came the next spring, as great a pet as ever. And there is no doubt that he was welcome.

Spanky does not, however, keep to the time-worn tradition that says the groundhog comes out on the second of February, and, if he sees his shadow, returns to his hole for six weeks while we endure as many weeks of bad weather. On the contrary, he comes out when he wishes, regardless of the date. Once it was as late as March twenty-first. And, contrary to popular belief, he is not afraid of his shadow. To prove this he makes it a point to appear on a nice sunny day, undaunted by the little shadow that persistently dogs his footsteps.

Then, too, Spanky has more intelligence than we thought a lowly woodchuck possessed. He knows his name, and will come when called. He is inclined to be jealous of any other animal that aspires to become the pet of the family. Yet he is not vicious in his resentment of intruders.

Life is not all sunshine for Spanky. He has his troubles too. Last summer he wandered over the hill to near the river, where he got his foot caught in a steel trap. But, being the intelligent little animal that he is, he chewed the string with which the trap was tied. Instead of hiding as wild animals often do when injured, he came dragging the trap to the door and stood patiently while we extricated his foot. He then ran into his hole and stayed a few days, returning little the worse for his experience. All in all we have found him an intelligent, lovable pet, and we have learned much about groundhogs from association with him.



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south. Time given is Standard Time; add one hour for War Time. Jupiter, in the map, should be a bit to the right of Pollux.

Star Magnitudes

By ISABEL M. LEWIS

STARS differ greatly from one another in brightness. Some rival the brighter planets in brilliancy. Others are so faint that they appear only after long exposure on photographic plates attached to the greatest telescopes. Others are too faint to be seen photographically with the most powerful telescope in existence. It is hoped that the great 200-inch telescope on Mt. Palomar, when it finally turns a photographic eye to the heavens, will reveal many millions of stars now invisible. For the purpose of comparing stars in brightness, either apparent or intrinsic, a scale was devised by astronomers many years ago. This is known as the stellar magnitude scale. Here magnitude is simply another term for brightness, and has nothing to do with the size or dimensions of the body.

On the stellar magnitude scale a difference of five in magnitude corresponds to a difference of one hundred times in brightness. For example, a star of magnitude one, a first magnitude star, is one hundred times brighter than a star of magnitude six, a sixth magnitude star. The scale is one in which the ratio is the fifth root of one hundred so that a change of one in magnitude corresponds to a change of approximately two and one-half times in brightness. A star of first magnitude is two and one-half times brighter than a star of second magnitude, which in turn is two and one-half times brighter than a star of third magnitude. A star of tenth magnitude is two and one-half times brighter than a star of eleventh magnitude and one hundred times brighter than a star of the sixteenth magnitude.

The use of the term magnitude to designate the apparent brightness of a star has been in use many centuries. Early astronomers, among them Ptolemy

and Hipparchus, divided all the visible stars into six magnitudes. In the first magnitude they put about twenty of the brightest stars and in the sixth the faintest visible to the naked eye. There were, of course, in those days no telescopic stars to think about.

Even after the invention of the telescope an arbitrary division of the fainter stars into magnitudes was used. There was no general agreement among astronomers as to what system should be used. A star, for example, might be listed as of seventh magnitude by one observer, and of eighth or even ninth magnitude by another observer. There was even more uncertainty as to the stars known as first magnitude stars, for some of them differed among themselves five times or more in apparent brightness, although all of them were classed as stars of first magnitude.

It was Sir John Herschel who noted, about the year 1830, that an average first magnitude star is about 100 times brighter than a star of sixth magnitude, and that, on the whole, observers had roughly maintained in their estimates of the magnitudes of stars a ratio of about two and one-half times between the brightness of a star of given magnitude and one of the next fainter magnitude. It was in 1850 that it was proposed, by Pogson, to adopt the now universal fixed scale of stellar magnitudes. It is customary to give the brightness of a star in Nautical Almanacs and star lists to tenths of a magnitude, although in certain instances they are given to hundredths of a magnitude. The smallest difference in brightness that can be detected by a trained eye has been found to be about one per cent.

When the new scale had been adopted it was found that zero and negative magnitudes were needed to take care of many of the brightest stars that had always been classed as stars of first magnitude. A star of zero magnitude is two and one-half times brighter than one of standard first magnitude and a star of magnitude minus one is two and one-half times brighter than one of zero magnitude and about six and one-third times brighter than one of first magnitude. So it was found that on the uniform scale finally adopted that Aldebaran and Altair are very nearly standard first magnitude stars; Capella, Arcturus, and Vega are nearly standard zero magnitude and almost exactly of the same apparent brightness. Canopus, the second brightest star in the heavens, is of minus 0.9 magnitude, and Sirius, the brightest, of minus 1.6 magnitude. Polaris, the North Star, is of 2.1 magnitude. The more southerly of the two stars that mark the tips of the horns of Taurus, namely Zeta Tauri, is of standard third magnitude. With a knowledge of the magnitudes of some of the well-known stars one can estimate roughly for himself the brightness of other stars. Variable star observers estimate the brightness of variable stars by comparison with some near-by star of known magnitude.

The brightnesses of planets are given also on the stellar magnitude scale and are variable, as their distances from the earth and phases vary. The brightness of Mercury varies from about two and one-half magnitude to minus 0.9, which is the brightness of Canopus; Venus varies in magnitude between minus 3.2 and minus 4.3, which puts it, at its *least* magnitude, nearly a full magnitude brighter than its nearest rivals, Jupiter and, on rare occasions, Mars. The brightness of Jupiter on the stellar magnitude scale varies from minus 1.4 to minus 2.3. Saturn varies considerably in brightness with the visibility of its rings. Its range of brightness is generally from about 0.5 to minus 0.5. It is brighter than a first magnitude star when least brilliant, and when seen under the most favorable circumstances is a rival of Canopus. Mars, with the greatest range of brightness of all the planets, is not much better than a third magnitude star on the stellar magnitude scale when farthest from the earth, but when nearest the earth under most favorable conditions it has a magnitude of minus 2.4.

It is interesting to note that on this same stellar magnitude scale the magnitude of the full moon is minus 12.5 and that of the sun is minus 26.5. At the distance of one meter the magnitude of a standard candle is minus 14.2, and at a distance of one kilometer, 0.8, or slightly brighter than a standard first magnitude star.

This same stellar magnitude scale used in comparison of the apparent brightness of the stars is also used for many other purposes, such as for estimating the apparent brightness of a newly-discovered comet, or nova, or a distant nebula or star cluster. It is also used in the comparison of the absolute magnitudes of the stars that give their true or intrinsic luminosities, or how bright they are compared with the luminosity of our own sun. The absolute magnitude of a celestial body cannot be known unless it is known how far it is from the earth. Its apparent (Continued on page 160)

A Lesson in Stoicism

SISTER M. BERNETTA, O.S.F.

Now through the open window drift the first
Weak trills of meadow larks upon the grass—
Yet I unmoving let the moment pass,
Not daring to allay the winter's thirst.

Some one reports the tulips are awake
And gossiping with crocus near the gate.
In other Aprils I could hardly wait
To kiss them welcome for their beauty's sake;

But now I change the subject, knowing how
Each bud contains the seeds of a typhoon—
Disaster rings the year's new pearl-cast moon,
And naught of spring can safely touch me now.

For who can tell what firefly may ignite
Grief's newly-buried store of dynamite?

The School Page

By E. LAURENCE PALMER

Professor of Rural Education, Cornell University, and Director of Nature Education, The American Nature Association

PAGING THE MILITARY NATURALIST

THE opening sentence in the War Department's *Basic Manual for Jungle Warfare*, FM 31-20, tells us: "In jungle warfare the soldier fights two enemies; man and Nature. Of the two, Nature is often the more formidable." It then devotes approximately 44 of its 79 pages to the problems of living in and off Nature, irrespective of human adversaries. We hope and believe that the introductory sentence in the *Manual* is truer than most of the sentences it contains on such important things as the identification of poisonous snakes. Reading the snake suggestions, one might suspect that they were written by fifth columnists intent on destroying our fighting men by giving them false information about Nature, the enemy that may be "more formidable" than man.

Life magazine in the first number of 1943 devoted a page to the dangers a soldier might expect if he did not examine carefully some of the things that live on the ground in the tropical and subtropical areas. It is highly doubtful if many experienced naturalists will agree with many of the recommendations made in this magazine article, or in the identification of and information about some of the snakes represented as being dangerous. It is equally doubtful if any naturalist who did not already know tropical natural history could use wisely the material to be found in the jungle warfare manual. If this is true of the naturalist, how much greater would be the probability that the untrained field Nature student would come to some dangerous conclusions by following this official guide.

The purpose of this article is not to disparage but to point out existing needs, and to make suggestions as to how these may be met.

Most units of our armed forces have officers whose responsibilities are highly specialized. Individuals may be charged with problems of transportation, of camouflage, of communication or intelligence. Others may be expert in dropping bombs from great heights, while still others direct torpedoes from undersea positions. There are radio experts, airplane pilots and skypilots. But where do we find the military naturalist whose primary responsibility is matching wits with Nature, which may well be "more formidable" than the human foes to be met?

Some Suggestions

This page proposes that officers be provided whose responsibilities may be somewhat as follows:

1. To provide military tacticians and other officers with valuable and reliable interpretation of the natural history of an area where action may be expected to take place; to be essentially liaison officers between Nature and those engaged in combat with men.

2. To provide adequate instruction of men who will go into action in strange country so that these men may remain as effectives as long as possible should they become detached from their units and be forced to "live off the land", and so that they may, in any situation, make a maximum use of whatever natural resources may surround them.

3. To prepare and distribute adequate guides and essential equipment for living off the land, carrying on communication and if necessary maintaining cordial and effective relationships with natives in the area involved.

4. To gather and organize the significant literature, and the talent from enlisted personnel and elsewhere, to the end that both may be used wisely, and so that intelligent use may be made of valuable forms of Nature in a given area and dangerous forms avoided. This relates to the problems of transportation over extended lines, and where local supplies of food should be used so far as possible.

5. To provide a channel for guidance of the military forces in meeting natural history problems in areas that have been conquered, or in non-combatant areas where the responsibility for making decisions rests primarily with those whose chief training has been military.

6. To provide a reliable channel of information that may prevent the military posted in relatively peaceful areas from abusing established conservation practices by such things as wanton destruction of animals that may offer themselves as convenient targets. This should lead to a better understanding between the military and civilians on matters dealing with Nature.

Qualifications

The proposed officers probably should be recruited from the enlisted personnel, and should include those who already have a good background in natural history. Any needed additional training could well be provided in some of the colleges where there are trained field naturalists. Special training could be provided in or near the areas where the officers may expect to find action. The officers might also serve as advisors in the wise development of the natural resources of an area after the military emergency has passed.

The content of any course of training should be determined jointly by the military interests and by those who understand the problems of Nature. Without any intention of being presumptuous, the writer suggests that those planning the course should consider the following fields as being important.

Food Problems: The recognition of plant and animal food organisms, how they may be procured, prepared and stored for maximum use, and their suitableness for use for different purposes. This includes the techniques of the capture of animals, the recognition of species suitable or unsuitable for food, and suggestions for maintaining balanced diets from local resources.

Health Problems: This should supplement or be integrated with work already being done by the Medical Corps. It calls for a recognition of pest species of plants and animals, of means of their control, and of the various climatic conditions that must be met. Some of these are mentioned, but most inadequately treated, in the *Basic Manual for Jungle Warfare.*

Human Relationships: There should be some understanding of the language, dialects, mores and human nature of the natives of the area for which training is being provided, with some understanding, for example, of the sign languages used in the area.

Weather: The military naturalist should have basic training in meteorology and in weather prediction, with special emphasis on (Continued on page 159)

THE KINGDOM OF SYNTHETICS

(Continued from page 126)

chemical industry is second to none in the world.

Through the peaceful conquest called research, we have gained access to a richer kingdom than was ever won by gun, sword, or bombing plane. But complete victory has not yet been achieved. The conquest is still being carried on by an army of more than 70,000 research workers in more than 2000 industrial laboratories in the United States, in addition to the thousands of other researchers in college, university, and Government laboratories. To keep this peaceful army in the field costs some $300,000,000 a year—less than one per cent of our military expenditures during the first year of World War II.

Products of the new chemical kingdom are to be seen on every hand—synthetic textile fibers stronger and more elastic than any found in Nature, now filling vital military needs; a complete rainbow of bright, fast colors from coal tar, more brilliant and lasting than even the "Royal Purple" of antiquity; chemicals that render fabrics water-repellent, moth-repellent, and even flameproof.

From Nature's mineral and vegetable kingdoms come the coal, limestone, salt, sulphur, petroleum, and grain used in making the "synthetic rubbers" vital to our prosecution of the war. Likewise from Nature's raw materials come the "building blocks" for man-made plastics to supplement scarce ivory, jade, and tortoise shell—but just now much more essential for a multitude of military uses, including the transparent noses of fighting planes.

Nitrogen—absolutely essential to the manufacture of smokeless powder and TNT, and just as vital to the farmer as to the soldier, was once obtained chiefly from natural nitrate beds in Chile. Today the chemist takes nitrogen from the air and transforms it into compounds needed for the manufacture of a wide variety of products, not only military explosives and fertilizers, but also dyes, plastics, lacquers, and healing drugs.

Tough, durable bristles for the brushes needed to paint guns, ships, tanks, and planes now come from the elements of coal, air and water, rather than from the backs of oriental hogs. Synthetic camphor from southern turpentine—chemically identical with that from the Formosan camphor tree—broke a long-standing Japanese monopoly and insures a plentiful supply for medicines and the photographic film so essential to military reconnaissance.

No longer is the medical profession wholly dependent on Nature for healing drugs. Daily the physician and surgeon turn to the realm of synthetics for chemicals to allay pain and reduce fever; for safe anesthetics; for vitamins to make up deficiencies in our diet; for the new "sulfa" drugs, which already have saved the lives of thousands suffering from pneumonia and various other ills, including battle wounds; and for synthetic hormones, those mysterious "chemical messengers" which aid in regulating both mind and body.

And the end is not yet in sight. Where will man turn to find the new products demanded by a social order whose very watchword is progress?

Where will the farmer turn for improved weapons to use in his unending war against insects and plant disease? Where will he seek for better fertilizer materials to increase crop yields?

Where will the architect and builder turn for materials of construction resistant to fire, rust and decay? In the field of transportation, where shall we turn to find light, strong materials able to stand the strain of ever-increasing speed by land, water and air?

Where will the physician turn to find positive cures for cancer, leukemia, and like "incurable" diseases that have plagued mankind since time immemorial?

Where, but to the laboratories of the chemical kingdom?

As we write, research is widening the scientific field to previously undreamed of dimensions. Already on the horizon—or possibly just beyond—are light, strong building materials, resistant to corrosion and decay; motor fuels of vastly superior power; direct utilization of the sun's energy; splitting of the atom—long regarded as indivisible—to liberate its vast store of power; a better understanding of the viruses responsible for the common cold and such dread maladies as influenza, yellow fever and infantile paralysis, all made possible through use of the electron microscope, which permits the bacteriologist for the first time to see the minute but deadly organisms; and man-made radio-active materials that bring new hope to the sick, these created by the atom-smashing cyclotron, which is capable of effecting even the transmutations sought by the ancient alchemist.

The unsolved problems of industry, of agriculture, of physical disease, of mental ills—all stand as a challenge to the skill, resourcefulness and persistence of the peaceful army battling to hold and expand the new kingdom of synthetics.

The challenge is accepted.

Tomorrow's Trees

"Trees for Tomorrow" is the title of a booklet prepared by the American Forest Products Industries, 1319 18th Street, N.W., Washington, D. C. It is a sequel to its earlier booklet, "American Forests", and presents the story of the forest industries' progressive management of private forest lands to provide successive timber crops and permanent forest communities. Both pamphlets are in popular terms and are available for teachers and others interested in the conservation and wise use of our natural resources.

Taxonomy

Systematics and the Origin of Species. By Ernst Mayr. New York. 1942. The Columbia University Press. 334 pages. Illustrated. $4.00.

Dedicated to "the army of taxonomists who have unselfishly devoted their lives to the task of describing and classifying the animals of the world" this book should be welcomed in the field of the biological sciences. The author, a distinguished zoologist and leading authority on the birds of Oceania and Indonesia, has a three-fold object in this volume. He first summarizes existing knowledge in the field of systematics, then analyzes the principal concepts on which taxonomic work is based, and, finally, presents some of the evidence supplied by systematists on the origin of species. The book is the thirteenth in the Columbia Biological Series and is based upon the Jesup lectures delivered at Columbia University in March, 1941.

Nature and Camouflage

Fifth in a series of War Background Studies published by the Smithsonian Institution, "The Natural-History Background of Camouflage" is an extremely interesting bulletin. Its author is Herbert Friedmann, Curator, Division of Birds, United States National Museum, and in an admirably illustrated text he discusses the component parts of what we know as camouflage (defined by the dictionary as concealment by disguise) and Nature's contribution thereto.

(Continued from page 157)

the part of the world where he may be expected to see action.

Physical Geography: The military naturalist should have significant training in meteorology, in map-making and reading, and in the problems of water supply and sanitation.

Engineering: The military naturalist should be able to help Engineer Corps men by knowing the values of woods to be found in a given area, and should be able to help provide suitable materials from local sources to supply the needs of engineers. This should include the use of local materials in camouflage and in other activities.

Outdoor Living: The military naturalist should, of course, know how to keep reasonably warm, free from hunger and thirst, healthy, safe and oriented in a strange area should he be dropped there suddenly and find himself quickly on his own. At least he should be able to make a maximum use of the resources he has or can find, and should be able to help others to do the same.

The content of the course should show recognition of the varied geographical areas in which combat will take place and not be limited to problems of dramatic jungles, deserts and seas.

These are but a few of the fields that should be considered in training this new kind of military man. The program would call for a more dynamic contribution to the war effort on the part of our trained naturalists than is possible by the activities of some of them who see Nature activities solely as appropriate for morale building in the camps and as competitors for the soldier's interest with the movies, dance-halls, saloons, and so on. It is true that any program such as this could not be developed without effort on the part of those responsible for it, but it is deserving of thought, effort and support. Since it is essentially identified with a new kind of Nature education, it is appropriate that it be proposed through the School Page of a magazine that has long pioneered in Nature Education. This does not imply that the program should be just "another school program". One way in which such a useful program might be stimulated would be through discussion by readers of Nature Magazine. The discovery of individuals or organizations who might be able to bring the idea to the military authorities might be one of the results.

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Your Dollars help make possible the

AMERICAN RED CROSS

This space contributed by the Publisher

EERIE LIGHTS

(Continued from page 135)

who have not, shuddered at sight of the lights or perhaps at only the thought of them, may be glad to be reminded that science has explanations of the phenomena, which should banish all eeriness. Certain bacteria living in putrifying substances, both animal and vegetable, are phosphorescent and make luminous the objects in which they become numerous. The simple glow in the rotten log or stump is produced by fungi that thrive in decaying wood in a moist situation. Lantern birds, seen by many people, including capable ornithologists in England, were barn owls supposed to have attained luminosity by having their feathers smeared with light-giving fungi growing in the tree cavities frequented by the birds. The wandering fires, lantern jacks and so on, collectively called *ignes fatui* (singular *ignis fatuus*) by the dictionary, are supposed to be caused by the combustion of marsh gas (methane). This gas being formed by decomposition of organic substances, my Carolina friend may have been correct in associating the fire balls he saw with the dead seamen; the gas may have come from their bodies. Finally another type of the lights seen at the tops of trees, steeples, and on the masts and yardarms of ships, is a brush discharge of electricity, reddish when positive, bluish when negative. This phenomenon is known as St. Elmo's fire or corposant (holy body) and by other names of like superstitious tenor.

Glad am I that my first acquaintance with these apparitions was the simple fox fire and in good company. Now, I think I could enjoy seeing the running and climbing balls of fire, a dancing will o' the wisp, or even a lantern bird, should fortune chance to bring them my way.

STAR MAGNITUDES

(Continued from page 156)

brightness or stellar magnitude varies inversely with the square of its distance from the earth. If its distance is known it is a simple matter to find out how bright it would be at some standard distance. The absolute magnitude of the star is defined as its stellar magnitude at some known standard distance. This is taken to be about 33 light years or ten parsecs. A parsec is an astronomical unit equal to about three and one-quarter light years. It is the distance at which the parallax of the body equals a second of arc, hence the name parsec.

At this distance of 33 light years the stellar magnitude of the sun would be 5, so the absolute magnitude of the sun is 5. That is, the sun would appear as a star of the fifth magnitude at a distance from the earth of 33 light years or ten parsecs. For all stars whose distances from the earth are known the absolute magnitudes can be found and they can be compared as light-giving bodies. One knows, then, not only how bright they appear to be but how bright, or luminous, they actually are. Our own sun turns out to be a dwarf star in this comparison. Aldebaran with an absolute magnitude of zero is 100 times brighter intrinsically than the sun. It is a giant star. Rigel is a super-giant with an absolute magnitude of minus 0.3; so, also, is Spica with an absolute magnitude of minus 2.5. There are many other giants and super-giants. Our sun does not appear as a particularly noteworthy body in the comparison of absolute magnitudes of many stars, although it is probably an average star. The dwarfs in the universe are many and the giants comparatively few.

HARMLESS SNAKES AS PETS

(Continued from page 152)

a month, and will rarely ever try to bite even when first caught.

The yellow-striped chicken snake of the southeast is also abundant and an equally fine pet. They grow to be more than seven feet long and are powerfully built. The scales or plates of the belly form a sharp angle with the sides of the body, causing the belly to be flat. The head is large and distinct from the neck, flat on the top, and the nose is blunt. The color is yellow or greenish, with four lines or bars of dark brown running the length of the body and tail. Specimens found on high ground around farms and open places are bright yellow, but others inhabiting dark swamplands are often dark greenish-yellow. Some of these snakes are spotted, with a gray ground color. They may be fed about twice a month on rats, mice, birds and small rodents. They will also eat eggs, and an occasional small chicken, if available. They are extremely beneficial to the farmer in the destruction of harmful rodents and should never be killed, but to the average farmer a snake is a snake, and as such is only fit to be ruthlessly slaughtered.

I have a beautiful pet chicken snake that I hatched out three years ago and successfully raised from a baby. The little snakes are not colored at all like the parent, but are gray with many small brown spots over the body. As they get older the brown spots merge into lines and the ground color turns yellow. Chicken snakes lay about twenty eggs, usually in June or July.

Discussion of snake pets would not be complete without mention of the corn snake. This gorgeous reptile is bright orange-yellow, with darker reddish-brown rhomb-shaped markings over the back and sides. The top of the head has a chevron-shaped mark, while the belly is an immaculate white with many black squares, exactly like a cross-word puzzle. It does not grow quite as large as the chicken snake, a five-foot specimen being considered very large. These snakes are seldom found in the woods or swamps but inhabit the barns and corn cribs of the farms, where they feed almost exclusively on mice. In captivity they will take also small birds such as sparrows. They are extremely hardy when kept as pets and become unusually tame, permitting themselves to be handled in most unceremonious fashion without ever attempting to bite. These fine and absolutely harmless snakes should never be killed or harmed. The corn snakes range from New Jersey to Florida and westward. They are not as common as the other species mentioned, but are the personification of everything beautiful and graceful and innocent.

Edible Mushrooms

Common Edible Mushrooms. By Clyde M. Christensen. Minneapolis. 1943. University of Minnesota Press. 124 pages. Illustrated in black and white, and color. $2.50.

With the problem of food complicated by war, neglected sources of supply take on greater importance. Various wild plants offer possibilities for the home menu, and not the least of these is represented by the edible mushrooms. Thus this book comes at an opportune moment and provides information on the identification, gathering and cooking of forty-five varieties of mushrooms. One chapter devoted to "The Foolproof Four" discusses the most common, most delicious and most easily recognized edible mushrooms. Color plates show eighteen species in full color, and are, therefore, a great aid to identification.

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men like this and help them win the war?"

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EVERY CIVILIAN A FIGHTER

CONTRIBUTED BY THE MAGAZINE PUBLISHERS OF AMERICA.

A typical trick of the little marmoset. When he suspected that there might be something in the mouth that he might be interested in he would pry it open and peer inside, as he is here doing with the author's wife.

THE LIFE AND LOVES OF IVAN THE TERRIBLE

(Continued from page 132)

passion or tenderness. They would sit together atop their tiny cottage in the sun, and he would comb her soft fur by the hour. He became particularly solicitous about the interior of her mouth and her teeth. Every so often, he would tilt her head back so that the light was just right, open her mouth and peer intently inside.

As gestation progressed, Tonita became ravenous and irascible, demanding her food in shrill, querulous tones. Several times she bit my hand when I was slow in placing her dish within her cage, but immediately afterwards she would be sorry. Then she would climb up her bar and make a funny little grimace of apology, or else chatter out a justification of her act. During this period Ivan gave her first chance at all the food, even to his beloved worms. On one occasion I caught a large spider and offered it to him, but he called her over and stood by contentedly while she devoured the whole thing.

Toward the last she became quite large and it was difficult for her to get around. When turned loose, Ivan would bound up the drapes, guide her with his calls and help her over the hard spots. She worried about his recklessness, and scolded him as though she feared he might fall and injure himself. They spent endless hours with their heads together, chattering softly, and if either got out of sight of the other there was much anxious whistling back and forth. Her cantankerousness faded and she became sweetly mellow. We cannot know what dreams and ambitions these tiny atoms had, but it seems to me the rankest human conceit to think that they could not dream.

Unfortunately I was out of town when the tragedy struck. I had left the tiny couple at home because of Tonita's condition, and one morning when my aunt and cousin came in to give them breakfast, Tonita lay sick on the floor outside her cottage. Ivan was distraught, and when an attempt was made to remove Tonita he attacked with such savagery that they had to desist. Finally, by wrapping an arm with a heavy cloth, my cousin was able to lift her out. Ivan hurled himself against the wire in a frenzy, so they laid Tonita on a blanket close by so that he could watch her. A drop of whisky and water perked her momentarily, but she grew steadily weaker, and died quietly before a doctor could get there. We do not know the cause of death. Perhaps her baby had died within her. So fell the tiniest star in my firmament.

Perhaps it is inappropriate to grieve over a monkey when death is striking all over the world, yet Tonita, a brown and yellow pixie that weighed but three ounces, epitomized the eternal female; one could sit outside her cage by the hour and watch her run the gamut of human emotions from tenderness and affection to shrewishness and anger.

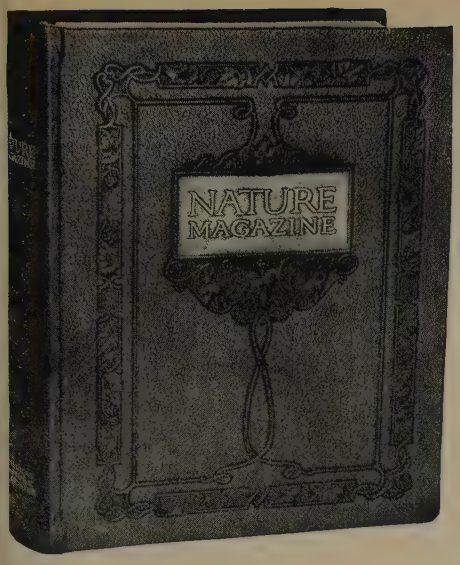
Ivan took it very hard. For a while he was completely lost. Sometimes he would give a shrill, eerie wail, as if trying to call into the Beyond. Always he watched the door, hoping to see her scamper in with that funny little crab-wise movement she had. He would stay up nights, a bewildered expression on his tragic face, dreading to retire, and it was heart-rending to see him crawl alone into their little cottage. For a long time he wanted to be babied. I took him out for romps, but he no longer cared to play. Instead, he would crawl down inside my shirt, and I could feel his tiny heart beating against my own.

Now that he is at last reconciled to the fact that Tonita is gone forever, he has transferred the bulk of his affections to my wife. She has taught him to blow kisses at her, but he will not do it when I am around. If she kisses me, he turns his back and sulks in jealousy. He considers me his rival. He is a great little guy, is Ivan the Terrible.

Yosemite Bears

Bears of the Yosemite. By M. E. Beatty. Yosemite National Park, California. 1943. Yosemite Natural History Association. 16 pages. Illustrated. 25 cents.

This is the latest of the special numbers of *Yosemite Nature Notes* and is of interest to all who have visited this National Park, or who are interested in bears. Dealing with the California grizzly, the Sierra Nevada black bear, and present bear policies and problems of the Park Service, this booklet provides interesting and valuable popular information. It serves to round out further the series that has included booklets on the Yosemite Indians, Yosemite birds, 100 wild flowers of the Park, and the cone-bearing trees of Yosemite. Each special number sells for twenty-five cents.



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Ivory-bill and Spoonbill

Two outstanding publications, of interest to all bird lovers and conservationists, have been issued as Research Reports Numbers One and Two by the National Audubon Society, 1006 Fifth Avenue, New York City. These deal respectively with the Ivory-billed Woodpecker and the Roseate Spoonbill. The first report is the work of James T. Tanner and is concerned with a bird of which perhaps not more than a half-dozen representatives remain, these, so far as known, in the so-called Singer Tract in Louisiana. This area, previously a sanctuary, is now being logged off rapidly, with inevitable destruction of the habitat of the remaining ivory-bills. In his studies Mr. Tanner ranged widely over the sections from which these birds had been reported, running down rumors of their presence and establishing no positive evidence that ivory-bills remain anywhere but on the Singer Tract. There he studied them. His report presents the whole story of these splendid birds, now, apparently, doomed to join the ranks of extinct American birds.

Thanks to the sanctuary program of the National Audubon Society, the striking Roseate Spoonbills find themselves in much better case. The story of their range, habits and present situation is told in the second report, by Robert Porter Allen, who covers the spoonbills both in Florida and Texas.

Both of these reports, which are popularly-written and illustrated with many pictures, including one fine colored plate of each bird, are available from the National Audubon Society at $2.50 each.

Topography

Geomorphology, Systematic and Regional. By O. D. vonEngeln. New York. 1942. Macmillan. 561 pages. Illustrated. $4.50.

The general field naturalist will find in this new book an excellent guide to the interpretation of physiographic problems. The organization of the book is different from many other books on the subject, and while this may confuse some readers it is more than amply offset by the excellent photographs, accompanied by interpretive drawings and block diagrams with which the book abounds. Of particular use is the section dealing with the Appalachian region, which is rich in physiographic problems, available for field study by a large proportion of our population, yet neg-

(Continued on page 165)

CLASSIFIED

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NATURE IN PRINT

(Continued from page 136)

Valley"; and Henry Potter, farmer and naturalist whose "round-of-Nature" journal will be the most precious part of the volume for many readers of this magazine. These are the authors of *The Friendly Mountains*—these and Professor Puffer and the editor, who is also the writer of *Mountain Geography*, "perhaps the only general book in English concerned with the principles of mountain life."

Mr. Peattie "trusts that this book will be especially welcome at the present time of crisis, when the beauties of our countryside are dearer and closer to us than ever before." I believe that I can assure Mr. Peattie that his work is indeed welcome and that, in this instance also, American readers will feel a gratitude to the publishers who have made the book available. It sets an enviable pattern for a series that we hope will progress rapidly. As Mr. Peattie surmises, although "wartime restrictions of all kinds may hinder us from putting into effect" all the recommendations of *The Friendly Mountains*, "the book will provide the best possible substitute for those who can not visit the ranges themselves."

Among those who may not for a time be able to visit those ranges is Sergeant Daniel Smythe, who has sent to me from Arlington, Virginia, his recent book of verses *Steep Acres*, which carries on its dust cover the poignant message: "Orders for this book should be placed directly with the author at Plaistow, New Hampshire."

I surely trust that there are those in Plaistow, New Hampshire, who can carry on Sergeant Smythe's correspondence during his absence, for his verses constitute some of the best poetry that I have seen newly-published for some time—beautiful and compact expressions in rhythm and rhyme and free verse of a young man who has observed keenly, thought deeply, and experienced a living with sympathy for life. He writes, of course, of the hills

> Offering a green strength and a new hope for the heart.

He writes also of the Empire State Building.

> I had expected nothing as great as this.
> Staggering me with a draught of a strong city.

He writes of people, of trees, of rural scenes, of April robins, but he writes also of the forces that now make the memory of hills and the songs of April robins as plaintive as they are inspiring. Riding eastward on a transcontinental bus, Daniel Smythe realizes—

> We are sawing away the miles, and as we grind,
> The night that buries Europe is hurrying to us.

Sergeant Smythe is now combating for all of us those forces of the Night that had already reached us before his verses were in print. It is in turn for him and his companions in arms, as well as for ourselves and the children of us all, that we who are left on the home front are unrelenting in our conservation purposes. If we are at times baffled, we share our problems with Sergeant Smythe, even as he a poet has shared his "Enigmas" with us:

> It seems a million years would not suffice
> To count in truth the sky's old mysteries.
> We walk through cryptograms of fog and ice,
> Guessing of things that haunt the dreams of trees.

> But beauty covers soil with splendid wings.
> Let us regard the rich amazing fact
> That hides within the whispering heart of things—
> Always beyond reach, holy and exact.

America's Natural Wealth: A Story of the Use and Abuse of Our Resources. By Richard Lieber. New York and London: Harper & Brothers. 1942. 245 pp., with foreword by Stanley Coulter, 11 photographs, 4 line cuts, chronology of events affecting conservation, and index. $2.50.

The Friendly Mountains: Green, White, and Adirondacks. Edited by Roderick Peattie. New York: The Vanguard Press. 1942. 341 pp., with 25 photographs, 2 line cuts, appendices on points of geological interest, guides and maps, elevations, and ski areas, and index. $3.50.

Steep Acres. By Daniel Smythe. Washington, D. C.: Anderson House. 1942. 95 pp., with 76 poems. $1.50.

About the Weather

Ways of the Weather. By W. J. Humphreys. Lancaster, Pennsylvania. 1942. The Jaques Cattell Press. 400 pages. Illustrated. $4.00.

Although most people know certain items of weather superstition, as a people we know universally less about the commonest of all subjects, the weather, than we do about most things of common interest. Dr. Humphreys, in his preface to this book, suggests that you test this statement. He says: "Ask your friends why a cloud, consisting, as it does, of water droplet or ice crystals 1000 times, roughly, denser than the air they are in, doesn't come tumbling down at once onto the earth. Ask them what makes the wind blow; ask why the trade winds blow from the east; why the air generally is colder on the top of a mountain than it is lower down; why a rainbow never is seen at noon on the equator; why Aurora's fingers are rosy, as Homer describes them, and what her fingers are anyway." He closes his preface by expressing the hope that this immediate volume is "an easy stairway, or even a gentle ramp, for some in this corner of the temple of knowledge." We should say that it was an escalator, presenting the facts of weather and how it comes about in interesting and understandable fashion. So long as the weather man must keep his prognostications a secret, one must do one's own forecasting. And even after victory is won the knowledge that may be gained from this book will be valuable in making one's own predictions and in understanding the details of the official scientific forecasts.

Oceanography

The Oceans: Their Physics, Chemistry and General Biology. By H. U. Sverdrup, Martin W. Johnson and Richard H. Fleming. New York. 1943. Prentice Hall. 1087 pages. Illustrated. $10.00.

As the first comprehensive textbook of oceanography in English, this book will be useful both as a reference and as an aid to anyone wishing to understand the interrelationships of marine animals to each other and to their oceanic environment. The many phases of oceanography are treated equally; there are chapters on tides, currents, chemistry, marine plants and animals, biological productivity and marine sediments. With the exception of certain chapters dealing with the physics and dynamics of the ocean, requiring a familiarity with calculus, the style is simple and concise. Each chapter is provided with a bibliography and the book is illustrated by more than 250 charts and diagrams. J. W. Hedgpeth.

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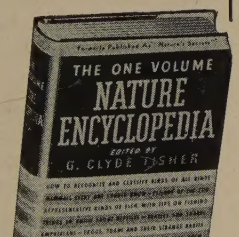

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(Continued from page 163)

lected unduly in many books on physical geography.

For those who are interested in the philosophies underlying the interpretation of landscape the book is not lacking. While many conflicting viewpoints are given a fair presentation, there seems to have been little attempt on the part of the author to recommend dogmatic acceptance of any one, or even to bias the reader in favor of viewpoints accepted by the author.

In some cases the brevity with which philosophies are presented leads to the assumption that some important ones are neglected deliberately or otherwise. It seems, however, that the author recognizes that further philosophical treatment might reduce the usefulness of the book to many readers. It is not an arm-chair picture-book guide to what you can see from the comforts of an automobile or train, nor is it a boresome tome designed to impress the reader with the erudition of the author, or to make a course based on its use "hard". It should find a ready acceptance by those who wish to take seriously an interpretation of topography in its broader significance. E. L. P.

Under the Surface

The Floor of the Ocean; New Light on Old Mysteries. By Reginald Aldworth Daly. Chapel Hill, N. C. 1942. University of North Carolina Press. 177 pages. Illustrated. $2.50.

An interesting non-technical discussion of the recent developments in submarine geology, containing much material previously accessible only in the technical papers and bulletins of geological societies. The problems of submarine mountains and the origin of submarine canyons receive especial attention. While Professor Daly makes an excellent case for his own explanation of the formation of submarine canyons, readers should remember that our knowledge of these submarine features is still very incomplete and that not all geologists agree with the author. The illustrations are well chosen and excellently reproduced. J. W. Hedgpeth.

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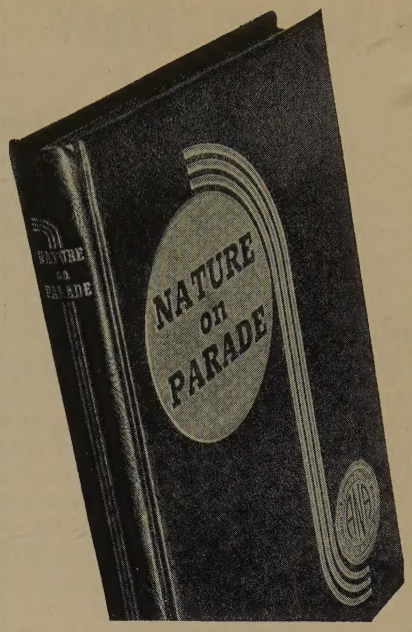

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Under the Microscope

By JULIAN D. CORRINGTON

FROG EMBRYOLOGY

The advent of March may mean epidemics of colds to some and income taxes to others, but for the biologist it heralds the revival of activity in frozen ponds, and particularly the emergence of frogs. From the last two weeks in March to the first two in April, depending on the latitude in which you dwell, the leopard frog, *Rana pipiens*, will come forth from his winter's sleep to breed, and suddenly the still ponds become loudly vocal as he joins spring peepers and cricket frogs in the evening chorus.

Most of us have at some time been instructed in the general outline of frog development. High school and elementary college courses use this abundant, inexpensive, and suitably-sized creature not only as a main source of information in anatomy and physiology, but in embryology as well. The eggs and tadpoles are easily maintained in a jar on the laboratory windowsill, and we watch the one-celled eggs become two cells, then four, eight, sixteen, and so on to the many-celled blastula stage. We are taught the significance of gastrulation, wherein the one-layered hollow ball becomes a two-layered hollow sac (primitive plan) but some of the details seem hazy to us at first because the fairly large amount of yolk present in the frog egg interferes with a diagrammatic execution of this infolding to make the future digestive tract. Other processes enter, and stage succeeds stage as growth in length and the sprouting of eye and gill rudiments appear. When the embryo wriggles free from the jelly envelope, it is properly termed a larva or tadpole, and proceeds to lead an active aquatic life, later developing legs, absorbing tail and gills, and coming on land—a profoundly interesting and significant change that repeats each year essential points in that greatest of Paleozoic events—the conquest of land by animal life.

The microscopist or other student specializing in advanced biological subjects cannot, however, be satisfied with this customary but superficial picture of external affairs. What is going on all this time under the hide of the future frog? You say an eye-bud appears on the side of the head: what do you mean by "appears"? Out of what is the incipient eye made, and whence came this stuff? The answer is given by sections, a good set of which will provide material for an almost endless series of studies on general schemes of development as a whole, as well as the differentiation of cells, tissues, and organs of all parts of the body.

Sections are cut in any of three planes: cross or transverse, sagittal (longitudinal and vertical), and frontal (longitudinal and horizontal). Of these, cross sections are by far the most valuable. Slides prepared commercially for sale to colleges are designated as typical sections, skip-serial (or spaced serial), and full serial sections, the last being essential for detailed studies or research. Furthermore, if slides are to be interpreted by textbooks then expedience demands the selection of a small number of specified ages of embryos. Development is a continuous process but must be studied in stages.

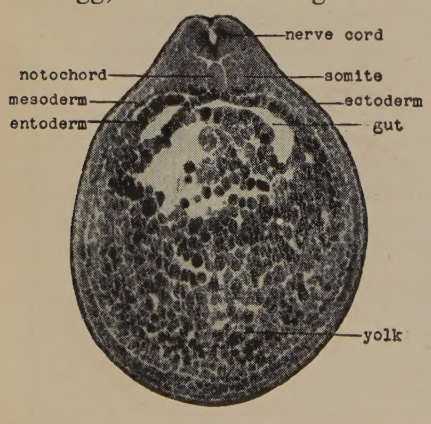
Slide equipment for an understanding of frog embryology should include typical vertical sections of an early cleavage stage, such as eight or sixteen cell, and of late cleavage, adequate to supplement views of whole eggs. Vertical sections pass through both animal and vegetal poles and are morphologically longitudinal. Gastrulation is studied by means of entire specimens plus typical sagittal sections, while neural groove and neural tube stages need whole mounts and typical cross sections. Slides designated as "typical" sections may bear from one to three or four sections. A good method is to select one median and two lateral or tangential slices and mount the three in proper order on the same slide. A complete serial ribbon of neural groove will make a dozen or more typical section slides.

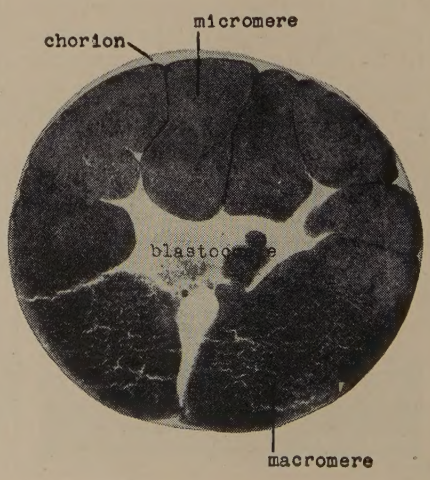
Full serial cross sections are next prepared of the tail bud stage or 3 mm. embryo, of the hatching stage or 6 mm. embryo, and of the tadpole stage or 11 mm. embryo, and these slides provide full details of histogenesis—tissue formation—and organogenesis. With these slides and a text or laboratory manual, some of which are cited herewith, the student may sit down and systematically work out one organ system at a time. In the digestive system, for example, the origin of the foregut is discerned and its many derivatives traced step by step, examining one section after another, slide by slide and age by age. The technique of all frog embryo preparations is more or less similar and will here be exemplified by making serial cross sections of a 6 mm. embryo.

Preparation of Serial Sections

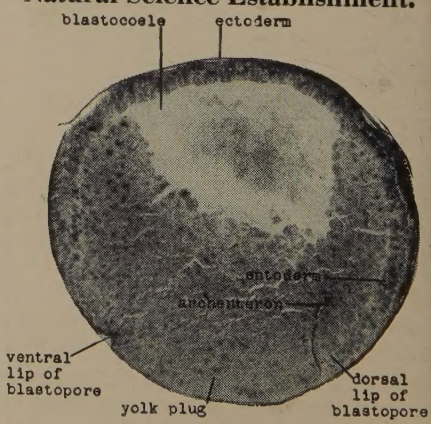
Remove several living embryos from the egg mass in the aquarium, or capture those that have recently become free, and determine the age by careful inspec-

Below, neural tube stage, frog; right, early cleavage stage, frog egg, both 50X enlarged.





Below, gastrulation, frog, sagittal section. Slides courtesy Ward's Natural Science Establishment.



on and measurement, using a and lens. Embryos are often, but correctly, called "eggs" up to this atching stage. Earlier stages must e freed from their jelly envelope, ne method being to roll them gent- along the edge of a blotter, using camel's hair brush, then pushing em off into a vial or watch glass the fixer just as the last of the lly is removed by adhesion to the lotter. The specimens are handled y sucking them into a dipping ube, which is simply the medicine ropper type of pipette with a raight glass tube substituted for ne constricted one. A favored ap- liance of similar nature is made by utting off the narrowed end of uch a pipette, annealing the cut nd, then slipping half of an inch- ength of rubber tubing over this lass end, the other half remaining ree for use as a rubber-tipped ipette.

One of the best fixing solutions or frog eggs and embryos is mith's Fluid, made as follows: .5 g. potassium bichromate is dis- olved in 87.5 cc. distilled water, nd then 10 cc. full strength com- nercial formalin is added. Just be- ore using, add 2.5 cc. glacial acetic cid. Fix for 24 hours, wash 6 hours n running water, then dehydrate lowly, beginning with a 15% al- ohol, then passing to a 25%, fol- owed by the usual series of 35, 50, 0, 83, 95, and 100 percents, thirty inutes in each, or use three hanges of dioxan for one hour ach.

Amphibian material is notori- usly difficult to section, especially he earlier stages in which there is large amount of yolk. One of the nost satisfactory methods uses Hance's rubber-paraffin-beeswax mbedding mixture, and while one f the ingredients is a war casualty t present, the formula is given for uture reference and to complete he subject. Chop up 20 g. crude heet rubber, either smoked or un- moked and dissolve in 100 g. smok- ng hot paraffin, with constant stir- ing. When cool, put in a container narked "Hance's rubber-paraffin tock"; to prepare for use, add 4.5 . of this stock and 1 g. beeswax to 00 g. commercial parawax, melt- ng together and filtering through aper toweling. To our knowledge, he only firm stocking this imbed- ling mixture already fully pre- ared for use is the General Biolog- cal Supply House, Inc., 761-763 E. 9th Pl., Chicago, and at last advice hey still had a supply on hand.

Cedar oil is a better clearer than ylene and, among the newer tech- iques, the *n*-butyl alcohol method s highly recommended for dehy- drating and clearing slowly and without overhardening or render- ing the objects brittle. After fixing and washing in water, the embryos are placed in a mixture of 90 cc. 50% ethyl alcohol and 10 cc. pure butyl for 2 hours; thence through the following changes: 80 cc. 70% ethyl, 20 cc. butyl, 2 hours; 65 cc. 83% ethyl, 35 cc. butyl, 4 hours; 45 cc. 95% ethyl, 55 cc. butyl, 6 hours; 25cc. 100% ethyl, 75 cc. butyl, 6 hours; 25 cc. 100% ethyl, 75 cc. butyl (repetition of preced- ing), 6 hours; pure butyl, 6 hours; pure butyl (fresh), 6 hours; 1 part butyl, 2 parts paraffin (or bayberry wax-paraffin, rubber-paraffin-bees- wax, or other mixture), 12 hours; the imbedding mixture or paraffin (without butyl), 2 to 3 changes, in oven, over a period of 4-5 days; imbed in fresh medium and section on a rotary paraffin microtome.

The best sections can be made with the celloidin technique, but the procedure is so laborious and difficult for serial sections that one of the foregoing is to be preferred. Cut sections 20 micra thick and have ready some albumenized slides. Reserve one inch at the left end of the slide for the label, then begin applying the paraffin ribbon across the top of the slide, making an upper row of sections from left to right. Sever the ribbon when at or near the right edge of the slide and begin at the left again with a second row, under the first, mount- ing every section in order. Continue in this way until the slide is full then, if necessary, start a second slide.

The following are some of the main points to keep in mind with this work: mount the paraffin block in the microtome in such a way that the head end of the embryo is the first part cut, the knife entering the left side of the body. If the rib- bon is now taken as it comes from the knife and turned so that the first cuts are at the operator's left and the later cuts at his right, keep- ing the same surface of the ribbon up, the mounted sections will be in serial order and upside-down, hence right side up when viewed through the microscope. Trim the block rather closely around the specimen, leaving a margin of only about 2 mm. of paraffin, otherwise cut sections cannot be mounted close together. While the top and bottom edges of the block,—the ones the knife enters and leaves,— must be strictly parallel, the two sides may be of any shape, and most technicians trim one so that it is vertical, the other oblique, so that the bottom is longer than the top. By so doing sections once cut from

Background for the Microscope

Equipment for the pursuit of microscopy may be as simple or as elaborate as individual inclinations dictate; but there is one item wholly indispensable —*books!* The microscope is handmaiden to all the sciences, and those who follow its adventuresome trail must have many a guide to direct along the right path.

Here is NATURE MAGAZINE'S selection of best bets. Check your library and add those that fail to answer the roll call. Buy one each month, or as often as you can. Suggest them as gifts. Buy them for the relative or friend whose chief joy is working with his microscope. Entries will be changed periodically; here is a basic list for a starter:—

MICROSCOPE

The Microscope, by S. H. Gage; 17th ed., most celebrated American work; very thorough.....$4.00

The Microscope, by R. M. Allen; Excellent new manual.....$3.00

MICROTECHNIQUE

Working with the Microscope, by J. D. Corrington; New guide for self help or classroom with graded series of lessons, from single to advanced. $3.50

Adventures with the Microscope, by J. D. Corrington; An informative and interesting text for the younger hobbiest or biological student. ..$5.00

Animal Micrology, by M. F. Guyer; Best general guide for histology and zoology at the college level.....$2.50

The Microtomist's Vade-Mecum, by A. B. Lee; Encyclopaedic reference, standard, advanced; botany and zoology. $9.00

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Photomicrography, by R. M. Allen; Splendid new work by recognized authority; complete; fully illustrated. $5.50

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the ribbon, or short pieces of ribbon, may always be correctly oriented. The 3 mm. embryo can be mounted completely on a single slide without difficulty, and the 6 mm. likewise after a bit of practice. Older stages will require more than one slide, however, and customary practice is to designate a series by a letter, a slide by a number, as "Frog Embryo, 11 mm., serial c.s., A-1," meaning slide 1 of series A. Should you prepare a second series of the same subject, it would be labeled series B. Some embryos, such as a 10 mm. pig, may require as many as 15 slides; the numbering not only permits keeping the series in order but makes it possible for student and instructor, in supervised laboratories, to question or discuss features. For example, the first appearance of some organ might be noted by observing section 3, row 1, slide 12, series G.

When the affixed sections have dried for at least 24 hours, they are deparaffined in xylene, two changes, then run down through the alcohol series to water, or passed through two changes of cellosolve to water. Many staining combinations are now possible, choice being largely a matter of personal preference. Delafield's hematoxylin and eosin is always reliable, though for this subject we prefer fast green as the counter-stain. Alum cochineal and Lyons blue is splendid, too. Mallory's triple will yield beautiful results but is difficult and tricky, and should not be undertaken as a first experience with this subject.

For those who would like to try their hand at one of the more advanced, and at the same time very beautiful staining combinations, we suggest the fuchsin-picro-indigo-carmine technique. From water, stain the slide 20 minutes in a saturated aqueous solution of basic fuchsin, rinse in distilled water, and counterstain for 5 minutes in picro-indigo-carmine, which is a mixture of equal parts of saturated aqueous solutions of picric acid and of indigo-carmine. Dehydrate rapidly by passing through 70, 95 and 100% alcohols, then half absolute alcohol, half xylene, then xylene, and mount in balsam. The 70% alcohol takes out the green, the 100% extracts the red, and only experience will teach the right duration in each alcohol to obtain perfect results.

Large rectangular cover glasses are used to cover serial sections. These are more easily broken than smaller ones, hence clean them very cautiously. A good procedure, after washing, is to rub them between two small blocks of wood, each block covered with a cloth, until dry and polished. Let such finished slides harden completely before using them, and when mounting on the stage of the microscope either do not use the spring clips at all, or apply them very lightly.

Text Books on Embryology

Huettner, A. F., *Fundamentals of Comparative Embryology of the Vertebrates*, Macmillan, N. Y., 1941. Reviewed in this Department, May, 1942.

McEwen, R. S., *Vertebrate Embryology*, Holt, N. Y., 1931. Reviewed, Feb., 1939.

Shumway, Waldo, *Introduction to Vertebrate Embryology*, Wiley, N. Y., 1935. Reviewed in this issue.

BIOLOGICAL LABORATORY MANUALS. IV. EMBRYOLOGY

A concise printed and bound manual of exactly 100 pages is *A Laboratory Manual for Vertebrate Embryology*, by H. L. Wieman and C. K. Weichert. This is a straight descriptive type, with full directions of just what to see and do, but no illustrations or other recent innovations. After preliminary instructions and brief exercises on germ cells and Amphioxus, the frog is quickly covered and the authors get on with the main business of the volume, a detailed study of the chick. The last section is concerned with mammalian development, with study of the 10 mm. pig receiving major attention. The directions are lucid, precise and exactly of the sort preferred by a great many teachers. McGraw-Hill Book Co., 330 W. 42d St., New York, 1930. $1.00.

Representative of the opposing school in biological teaching is *A Laboratory Manual of Vertebrate Embryology*, by F. B. Adamstone and Waldo Shumway. This work is of notebook size and has rag covers, spiral binding, perforated and punched extra drawing sheets, spaces throughout for required drawings and notations as to section locations, and 38 figures consisting of 59 pen drawings. Work begins at once with the frog, which is covered in very considerable detail (30 pages), then chick (35 pages), and finally the 10 mm. pig (21 pages). In connection with the 6 mm. frog and 48 hour chick, typical sections are illustrated and described in detail, as a working basis for examination of full serial sections by the student, making the descriptions briefer and more graphic. All of the instructions are very well written; careful as to wording, thorough, brief. John Wiley & Sons, Inc., 440 Fourth Ave., New York, 1939. $1.25.

From the standpoint of the teacher, there is little to choose between these two manuals; both are excellent, with slightly different coverages and presentation. For the amateur working alone, the second is probably preferable because of the illustrations.

TRADE NOTES

The third edition of a very successful work on embryology was issued in 1935; this is Waldo Shumway's *Introduction to Vertebrate Embryology*, the most comparative elementary text on the market. Fairly brief for a book in this field, the text is divided into five parts: introduction, with definitions, history, and a preview of developmental stages in the four types stressed throughout—amphioxus, frog, chick, and man; early embryology, covering the gametes and their formation, fertilization, chromosomes and genes, cleavage and gastrulation types, embryonic form and the extra-embryonic structures, and experimental embryology; organogeny, with all structures included, the first classification being by germ layer, the second by organ system; anatomy of vertebrate embryos, being essentially an atlas of frog, chick, and 10 mm. pig; and embryological technique, with directions for preparation and study of material. There is a full glossary, and references appear at the end of each chapter.

For the biologist, as opposed to the medical student, this is a far more valuable and interesting arrangement than the older style of purely descriptive embryology. By consulting an appropriate chapter, the reader may follow out either a process, an organ or system as it develops, or study the complete anatomy of an embryo of given age. The style is excellent and the illustrations splendid and numerous; the material voluminous yet condensed; the work authoritative for text or reference. Pp. xii, 390; figs. 240. John Wiley & Sons, Inc., 440 Fourth Ave., New York, 1935. $4.00. Accompanying laboratory manual described above.

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This department is at the service of all those interested in microscopy. If any knotty problems confront you and seem to defy solution send them to this department, Nature Magazine, 1214 Sixteenth Street N.W., Washington, D. C. Inquiries and requests for advice will be answered by mail just as soon as the pressure of time these days permits.